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Windows for Workgroups: Another Winner For Microsoft?

16.8 Million Colors To Choose From: Three 24-Bit Paint Programs for PCs

New: Inside PC Labs' Hardware Benchmark Tests, Release 7.0

PC MAGAZINE

PC LABS TESTS 48 UPGRADABLE SYSTEMS IN 220 DIFFERENT CONFIGURATIONS FROM 386/25s TO 486DX2/66s

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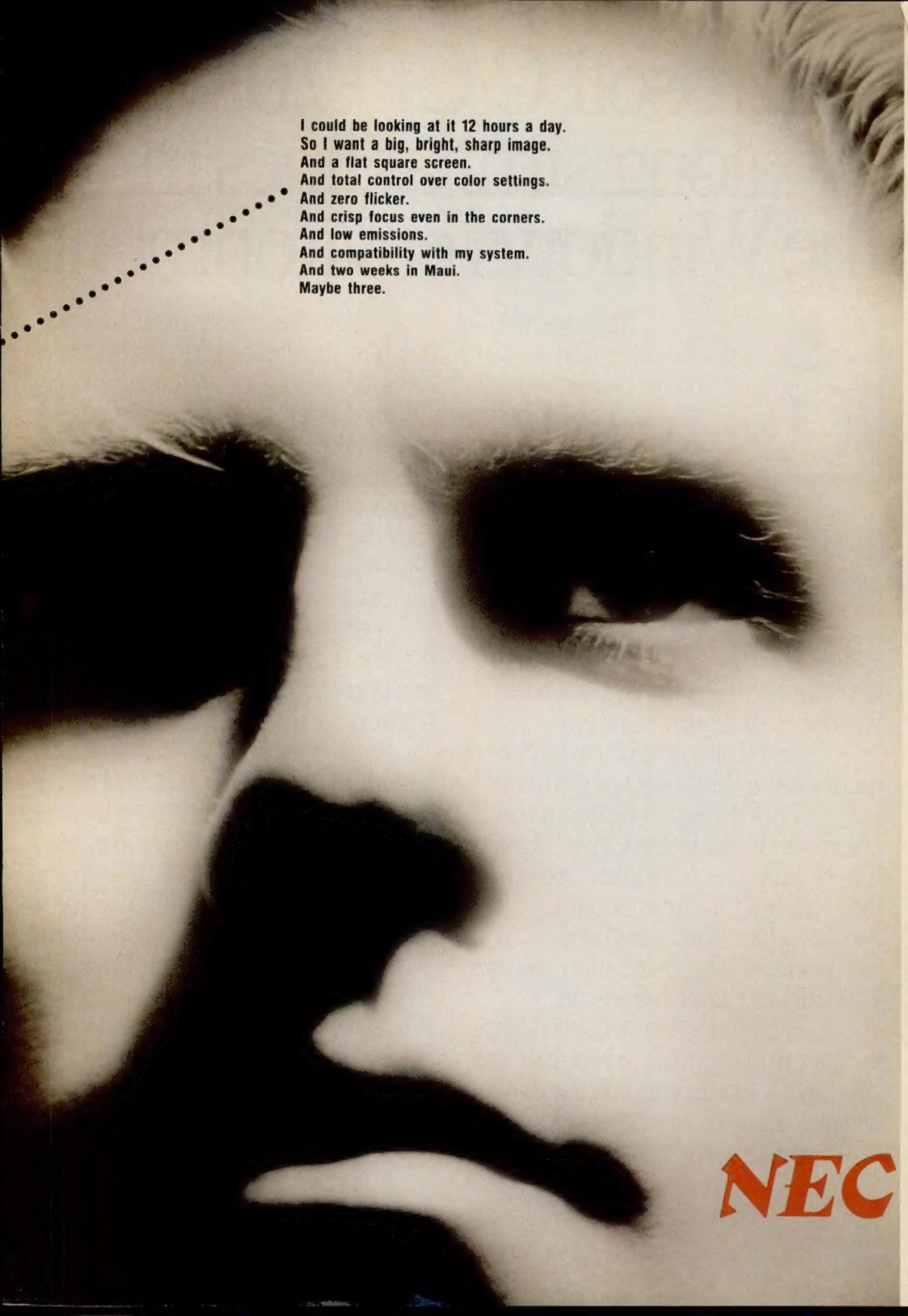
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Inside

The front of a magazine gets all the glory. Articles in the middle are hard to miss. Anything in the back is in danger of being overlooked. But many of our readers know there's buried treasure in the back of this magazine: tips and tricks for the average user, advanced techniques for the programmer.

PC Magazine has always concluded each issue with technical articles and columns. Our programming coverage today is more extensive than ever. And it shows: Our surveys tell us that more programmers read our technical columns than read any other computer magazine, including publications targeted at programmers.

Our technical help columns offer readers everything from advice on what to buy to insight on solving your computer problems to software and hardware tips and techniques. We've had columns on spreadsheets, word processing, databases, and connectivity. Now we're in the process of expanding the help section.

Beginning with this issue, we're combining most of our Q&A columns into one large column—Solutions—in order to cover more ground. The Solutions section will answer questions about PCs, multimedia, graphics, fonts, and much more. We've added several new experts to our list of advisors; their deep knowledge of today's technologies and industry developments will make Solutions all the more authoritative.

The person in charge of our technical columns is senior editor Trudy Neuhaus, who has been with *PC Magazine* since 1988. Neuhaus, who took over the columns in 1990, leads a team with an enthusiasm for the nitty-gritty details of how computers really work. Neuhaus, associate editor Sharon Terdeman, technical editor Neil J. Rubenking, staff editors Craig L. Stark and Michael Muchmore, and assistant editor Ellyn McCasland are a team dedicated to details, and they bring a blend of experience and expertise that will serve you well.—*Joel Dreyfuss*

Tech editors (clockwise from left): Muchmore, Neuhaus, Stark, Terdeman, and McCasland.

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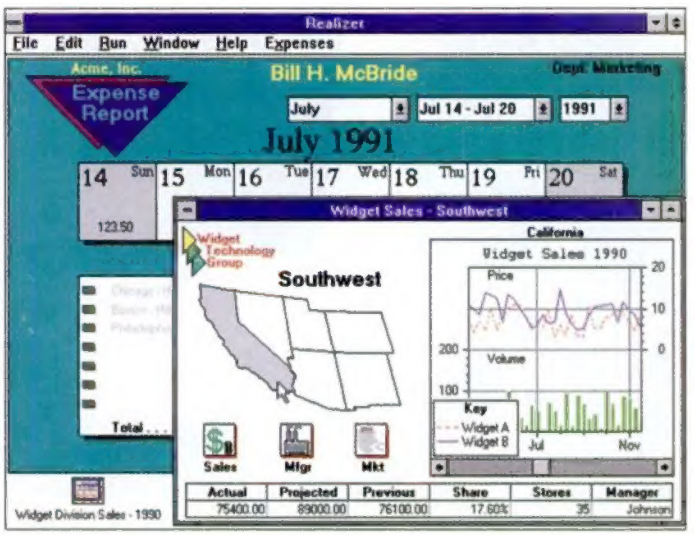

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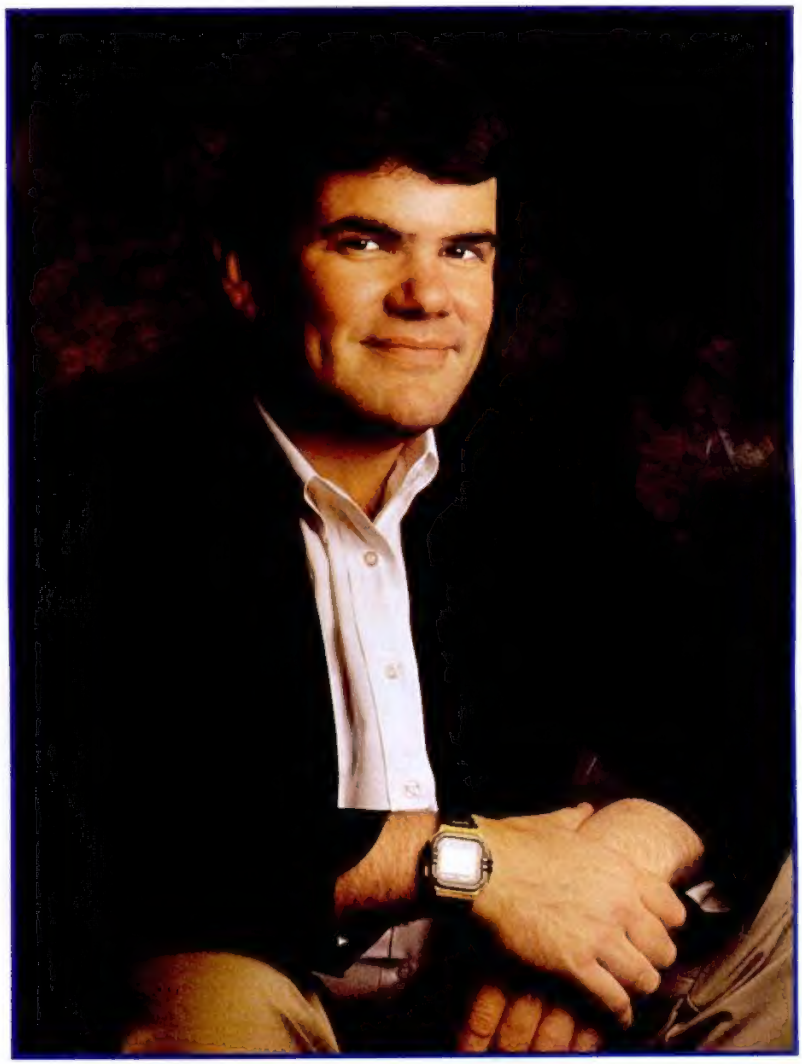

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BY JIM SEYMOUR Personal computers designed for easy upgrades allow you to keep up with a rapidly changing technological world. *PC Magazine* tests 48 of the newest systems that promise to delay your computer's obsolescence **110**

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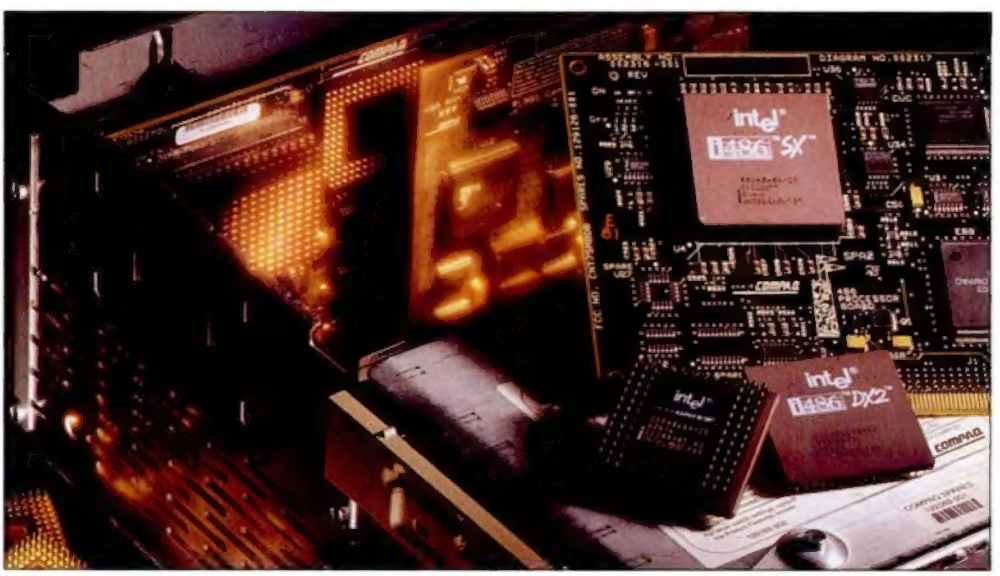

Supercharge your PC by updating its processor (page 110).

Photography by Ralph Masullo

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Windows for Workgroups

BY FRANK J. DERFLER, JR., AND STEVE RIGNEY Networking just got friendlier. With nearly seamless integration of peer-to-peer file and peripheral sharing, LAN connectivity, and the familiar Windows interface, Microsoft Windows for Workgroups may supply the ideal connectivity solution for people who previously only networked only at parties 255

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Three paint packages that may inspire you to trade in your easel for a PC (page 363).

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Negotiating the Fax Modem Jungle

BY RICK AYRE Many modems today also include fax capability, but few give you as much functionality for faxing documents as for transferring data. In this companion piece to our fax software story, ZD Labs tests 12 high-speed fax modems from seven vendors to find out what to expect and what not to expect, from the pack 343

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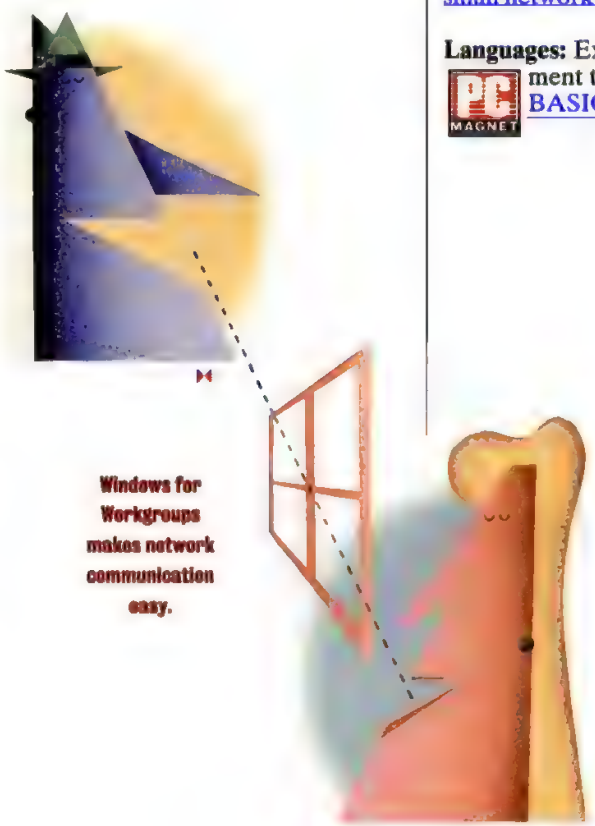
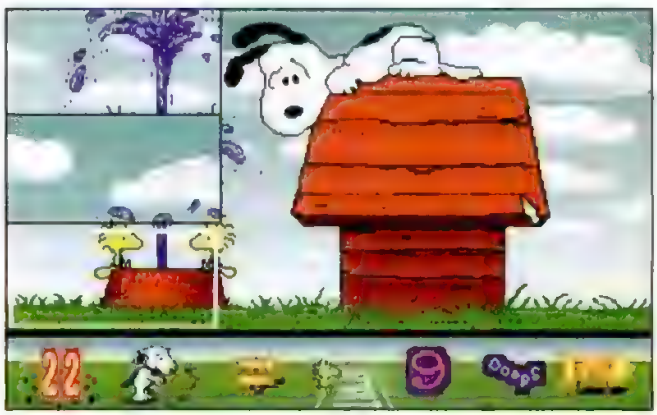
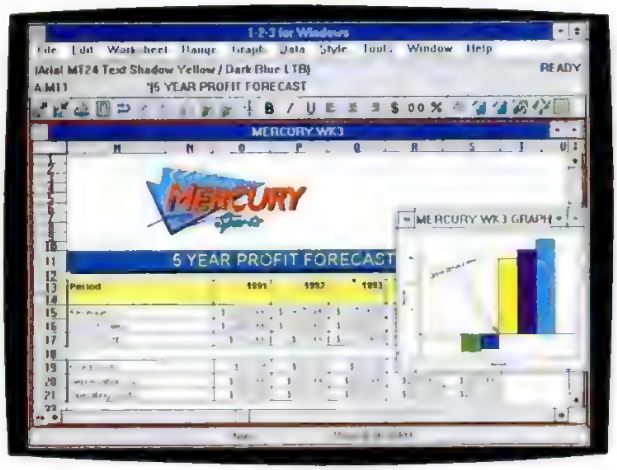


Windows for Workgroups makes network communication easy.



Snoopy's Game Club teaches young children basic skills.

Compared to Lo
Microsoft Office look



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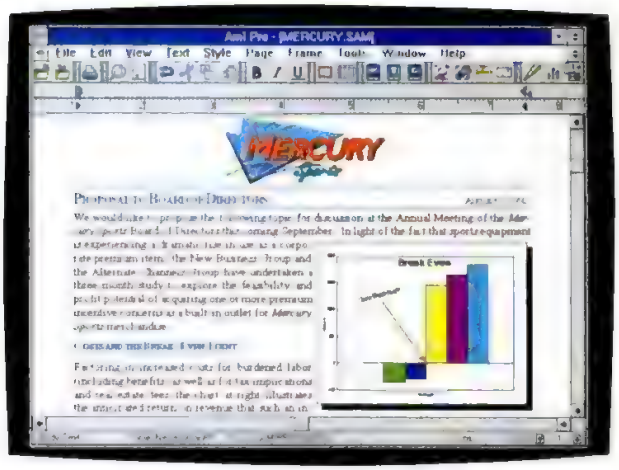

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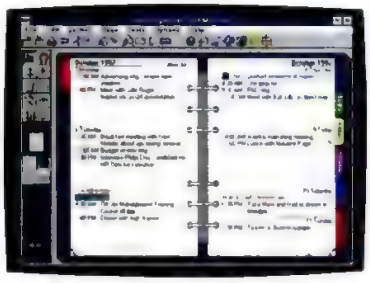

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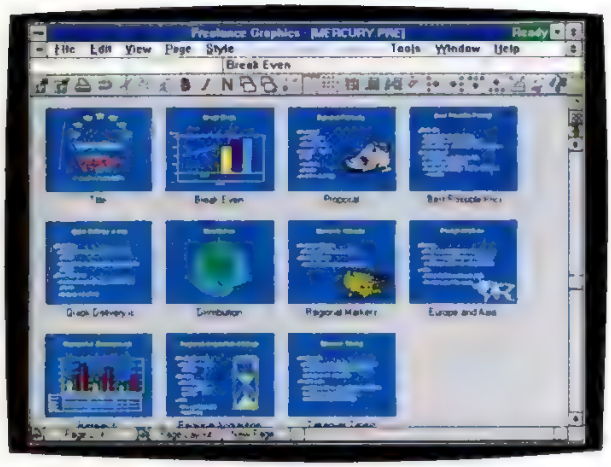

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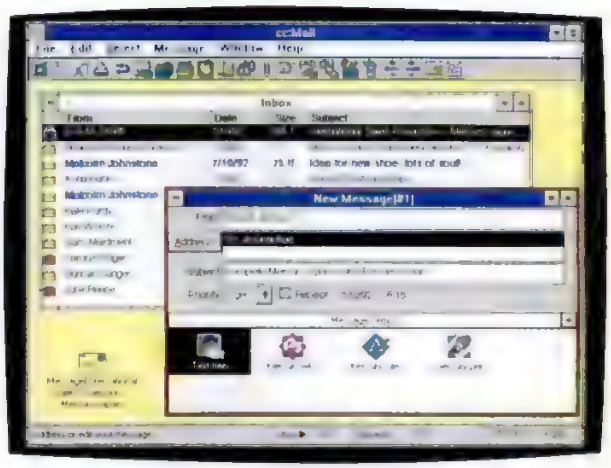

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PC Magazine Reviews

Except where noted: All *PC Magazine* reviews are of currently available products. Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25e's.

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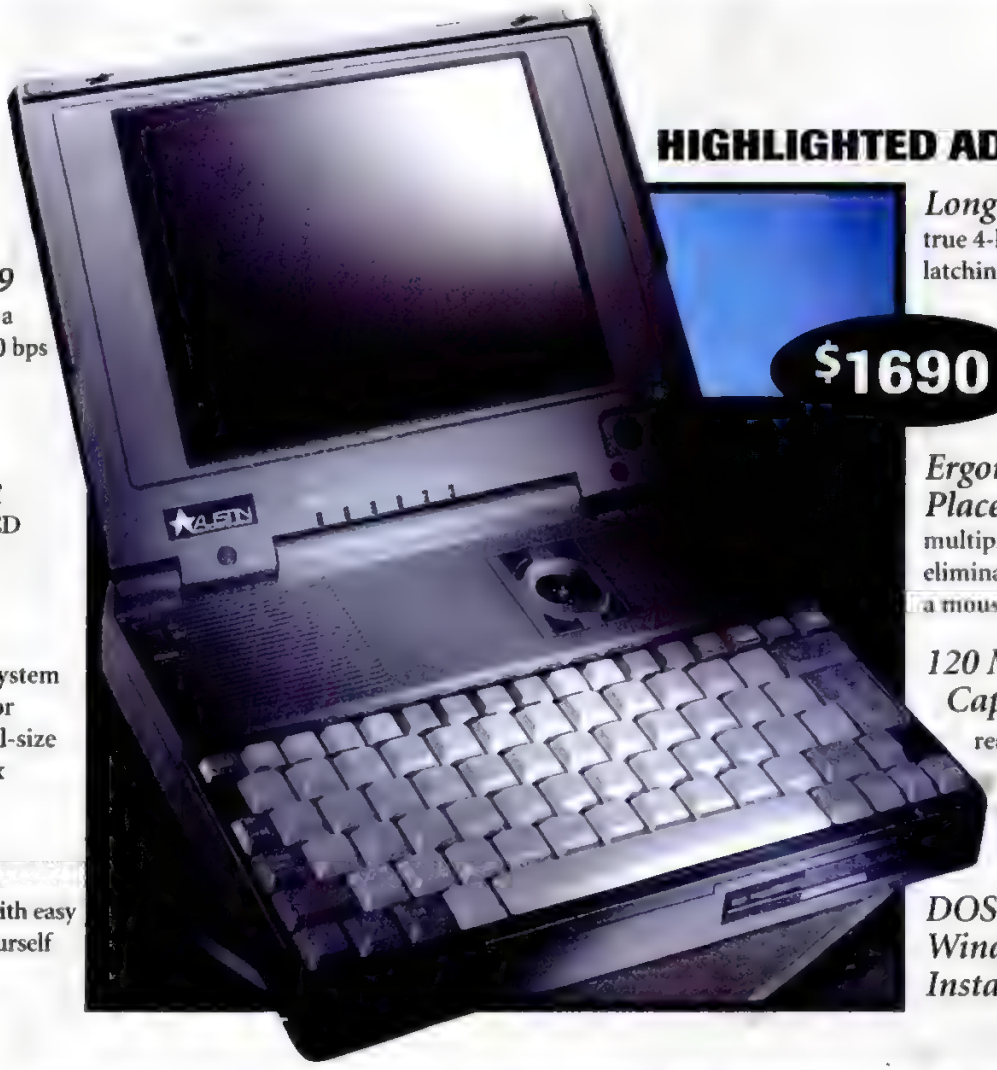

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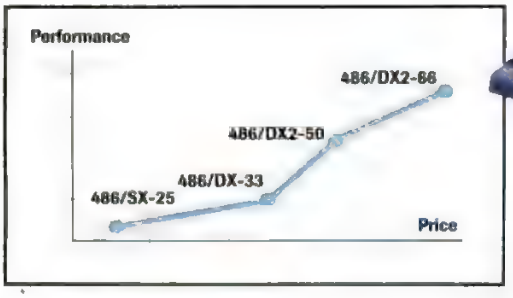

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"The Austin 486/33i WinStation packs a lot of performance and expansion into a compact package. It is attractive, aggressive and affordable."

PC Magazine Contributing Editor Winn L. Rosch

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PC-AF-2

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Cyrix 486SLC running at 33MHz	Intel i386, 33MHz w/64K Cache	Cyrix 486DLC 40MHz w/64K Cache	Intel i486, 33MHz w/128K Cache	Intel i486DX2, 50MHz w/128K Cache
4MB RAM (to 32MB)	4MB RAM (to 32MB)	4MB RAM (to 32MB)	8MB RAM (to 32MB)	8MB RAM (to 32MB)
80MB Hard Drive	80MB Hard Drive	210MB Hard Drive	210MB Hard Drive	210MB Hard Drive
14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video	14" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video
1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives
101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard
DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1 Mouse
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Intel i486 running at 50MHz w/128K Cache	Intel i486DX2 running at 66MHz w/128K Cache	Intel i486DX2 running at 50MHz w/128K Cache	Intel i486DX2 running at 66MHz w/128k Cache	386SX1 running at 25MHz 2MB RAM (to 8MB)
8MB RAM (to 32MB)	8MB RAM (to 32MB)	8MB RAM (to 32MB)	8MB RAM to 32MB	120MB Hard Drive
210MB Hard Drive	210MB Hard Drive	330MB HD, EISA/SCSI Cont.	330MB HD, EISA/SCSI Cont.	9.4" VGA LCD Display, 640x480 w/ 32 gray scale
14" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video	15" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video	14" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	15" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	1.44MB Floppy Drive Built-In Track Ball
1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	79-Key Keyboard
101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	DOS 5.0 Pre-Installed
DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse	6.2 lbs. with battery
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Letters

MACROS DON'T MAKE THE PROGRAMMER

"Nothing In, Nothing Out" (September 29, 1992), by William F. Zachmann, hit the nail on the head. An unfortunate side effect of the desktop computer is that management thinks writing a macro in Lotus 1-2-3 is programming. Our MIS shops are full of accountants and MBAs whose computer science education was a 3 hour course introducing COBOL. Naturally, these people have little if any appreciation for quality assurance. They simply can't tell the difference between good code and bad.

It's time management realized that what they are doing makes as much sense as putting the distribution department in charge of the company's finances.

Randy Bracewell
Houston, Texas

MACHO, MACHO MAN...

My first reaction to John C. Dvorak's column "The Bonehead vs. the Power User" (September 29, 1992) was irritation, but that quickly turned to amusement. What a man! I'll bet he can bend keyboards into horseshoes and rip thick printouts in two with his bare hands! I imagined Dvorak standing before the swinging doors of the executive washroom, his hand suspended over the handles of the matched pair of 486/66's strapped to his hips, and his steely eyes sweeping the room menacingly from behind his spectacles as he announces to all present "Windows users are geeks."

Russell Schoof
Molalla, Oregon

I waited with anticipation to read John C. Dvorak's latest slam of Windows. "The Bonehead vs. the Power User" promised to be no disappointment. That is, of course, until I got to the sentence "Windows is, at best, a priggish, effeminate interface modeled after the sissified Macintosh operating system interface."

Perhaps the bonehead finally showed his true colors. This is the most misogynistic, disrespectful comment I have ever read in *PC Magazine*. I typically do not read *PC Magazine* for political correctness, but I simply cannot ignore such blatant disrespect for those of us devoted to equality and respect for all.

Michael Gonzales
Irvine, California

Avoiding GIGO and NINO is not a job for amateurs. It requires pros.

IS IT SOUP YET?

I was quite appalled when I opened your August 1992 issue and read the poor review that was printed on our 386SL/F notebook. In reviewing the benchmark test results, Bondwell was very consistent with the majority of manufacturers on all but the video and graphics test; however, the overall review leads readers to believe that the 386SL/F is an inferior machine.

The unit that was sent to you for evaluation was one of the original preproduction run machines. This was made very clear to your staff when the unit was requested. Now that we are in full production, I feel that you should do a reevaluation of the 386SL/F.

Alice Law
V.P. Sales & Marketing
Bondwell Industrial Co.

• *PC Magazine*'s policy is to review shipping products, and our requisition letters always include that notation. PC Labs did retest the battery performance of a second, shipping-level Bondwell 386SL/F and found these results: worst-case rundown, 2 hours 2 minutes; ZDigit rundown with power conservation enabled, 2 hours 47 minutes.—Ed.

LEFTIES GET A BREAK

Being a "southpaw," I prefer having the trackball on the right-hand side of a notebook because I can use my right hand to use the trackball and my left hand to type.

In Jim Seymour's "A Trackball in Every Notebook" (September 29, 1992), there is an apology—"sorry, lefties"—for notebook trackballs being on the right side. Inadvertently, it may seem to favor right-handed users, but in fact it is a big plus for left-handed people who have learned to be ambidextrous in a right-handed world.

Sy Seltzer
New York, New York

MORE POWER TO YOU

Michael J. Miller's column "The Compatability Curse" (September 29, 1992) addresses a matter that has troubled me for some time. There is a great push in the PC chip market to build increasingly faster and more sophisticated machines. Few people point out the contradiction between today's CPU capabilities and DOS's lack of ability to exploit the full power of these chips. How many people have upgraded because they thought they needed more processing power, when simply having a modern operating system could have given them the extra power they needed?

Steven K. Byers
Bowie, Maryland

MOZART WE AIN'T

In "MCI, MIDI, and the Nature of Time" (Environments, September 29, 1992), you state, "A whole note (an open oval) is twice as long as a half note (a closed oval), which is twice as long as a quarter note (an oval with vertical stem)."

Actually, a half note is an open oval with a vertical stem and a quarter note is a solid black oval with a vertical stem. Minor slips aside, I enjoyed the article.

Irving Franklin
Los Altos, California

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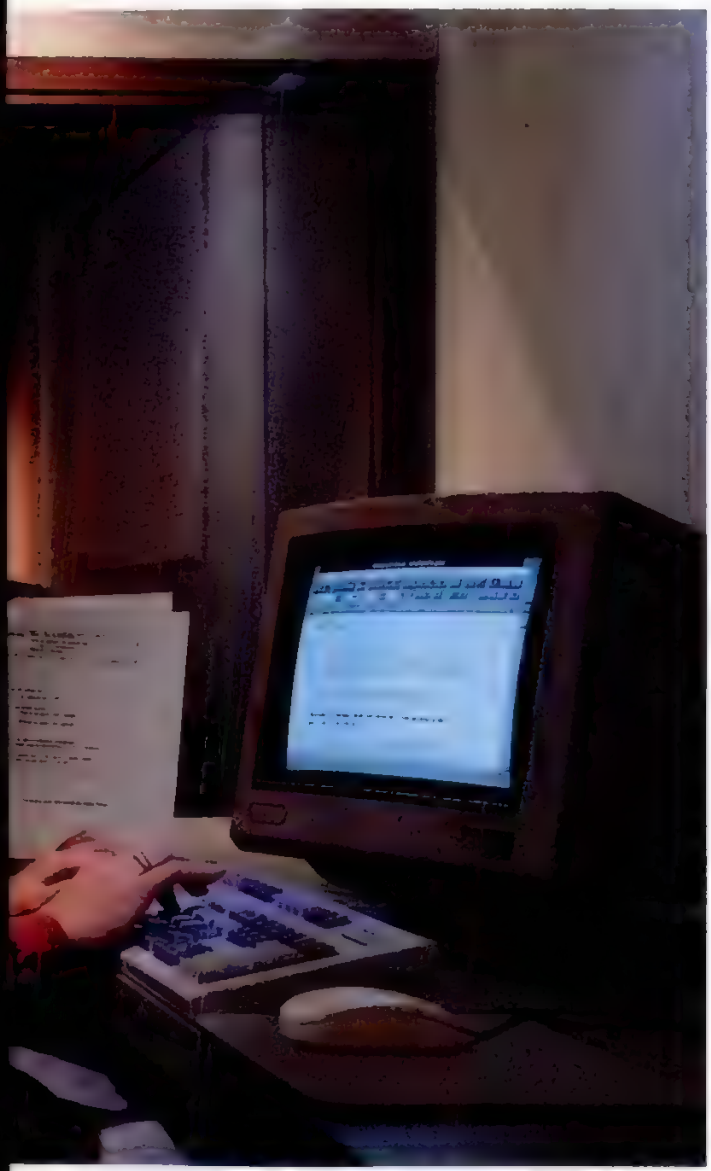

users to try it out on the things they do every day at work. We call these types of sessions "usability studies." They help us find out the way in which people use their computers, and how we can make it easier for them.

In this case, we were able to design features that can make not only your everyday work easier, but also the transition from WordPerfect.

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We even had the National Software Testing Labs put Word for Windows to the test in ten cities across the country. The result was that nearly 8 out of 10 WordPerfect users preferred Microsoft Word for Windows for ease-of-use over WordPerfect for Windows.

But they're not the only ones who prefer Word for Windows. This year, it received numerous industry awards, including "Best Buy" by *PC World*, and "Editors' Choice" by *PC Magazine*.

To find out how easy it is to make the switch to Word for Windows, just give us a call at (800) 426-9400, Dept. HY9. And then spread the Word.

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LETTERS

WHAT IS THAT TINNY SOUND?

In First Looks (September 29, 1992), a review of the Pro AudioSpectrum 16 contained the following statement: "The tinny high-frequency 'folding' distortion created by 8-bit boards is completely eliminated on this 16-bit card."

This is probably not the best explanation of why the tinny sound is gone, since high-frequency folding, or aliasing, is not related to the number of quantization levels. Aliasing is a function of only two quantities: the sampling rate and the frequency bandwidth of the sampled signal. 16-bit quantization does not eliminate high-frequency "folding" distortion, it just folds the higher frequencies more accurately.

Gerald D. Myers
Ellicott City, Maryland

NOT DEAD YET...

"DOS Lives!" (October 13, 1992) is an outstanding piece of work. Along with its accompanying articles, the piece presented both supporting and opposing views on the continuation of DOS for the present and the immediate future. That entire section was well thought out, well laid out, and was far more interesting reading than any of the material written by *PC Magazine*'s regular columnists. The smoke signals sent out by Windows and OS/2 software manufacturers were having many of us believe that DOS was soon headed to software heaven.

Leo Salerno
Las Vegas, Nevada

SILENCE IS GOLDEN

In a modern office building, complete with its heating, ventilation and air-conditioning systems and the accompanying ambient noise levels, state-of-the-art personal computers and their peripherals do not add much to the high levels of noise already present. In fact, for all but the quietest offices, it is sometimes difficult to tell whether or not a piece of equipment is running.

In the home environment, be it an office, den or playroom, the mechanical sounds produced by the same innocuous office equipment make for a cacophony of unwelcome proportions.

Computer manufacturers need to discover that a considerable market exists for much quieter equipment. I dread the idea of a hot P5 chip, if a fan to cool it makes more noise than a 9-pin dot matrix dinosaur.

Clinton Ross
Danvers, Massachusetts

Brought into the home environment, the mechanical sounds produced by the same innocuous office equipment make for a cacophony of unwelcome proportions.

IT'S MY PC

Companies that stick those secret little ego inflators in their high-powered, high-cost Windows programs hog up my precious RAM and hard disk space without even telling me about it.

This is my PC, not Lotus's or Microsoft's. Their secret messages may be cute, but I want to decide how to allocate my hard disk and system memory.

Karl Polcek
Belle Vernon, Pennsylvania

GIVE 'EM A BREAK

The review of the Compaq Deskpro 486S/25M in "486SX: The New Entry-Level PC" (October 13, 1992) completely ignored the fact that the M series is Compaq's most expensive line of machines.

Anyone not living under a rock knows that both the "i" series and the Prolinea line are more cost-effective, yet your reviewer insists on giving the wrong impression by saying, "though stories have been flying regarding Compaq's attack on high prices, this kind of performance is still mismatched with the price tag."

Compaq's pricing changes and its new lines of computers have had a major, positive impact on the marketplace.

Scott Feuless
Houston, Texas

EASIER THAN YOU THINK

Regarding Mr. Zen Miller's remarks about WordPerfect (Letters, September 29, 1992), the clean screen of WordPerfect 5.1 for DOS makes it possible to teach a complete PC novice to type plain paragraphs with word wrap, save them to disk, and print them in less than 10 minutes. This user would not employ perhaps 99 percent of the programs features, but the point is that these features remain unobtrusively in the background and do not hamper simple tasks.

Jordan V. Hodgson
Torrance, California

CORRECTIONS AND AMPLIFICATIONS

In "DOS Lives!" (October 13, 1992), we incorrectly identified the manufacturer of Back & Forth Professional. The actual manufacturer is Progressive Solutions Inc.

The First Look evaluation of IIT's XtraDrive (September 29, 1992) misstated the effects of losing the XtraDrive driver. If the driver is lost you still have access to the hard disk, but the data compressed by XtraDrive will be inaccessible.

In "VGA-to-NTSC Boards: Let's Go to the Videotape" (September 29, 1992), we incorrectly showed a photograph of IEV International Inc.'s VGA Broadcaster board instead of Editors' Choice recipient Magni Systems Inc.'s VGA Producer Pro board.

We gave the wrong version number of Sloop Software's Sloop Manager in "20 Ways To Remodel Your Desktop" (September 29th, 1992). The correct version was 1.2b.

HOW TO WRITE TO PC MAGAZINE

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With Norton Desktop for Windows, your drive icons sit right on the desktop, so you get direct access to your files.

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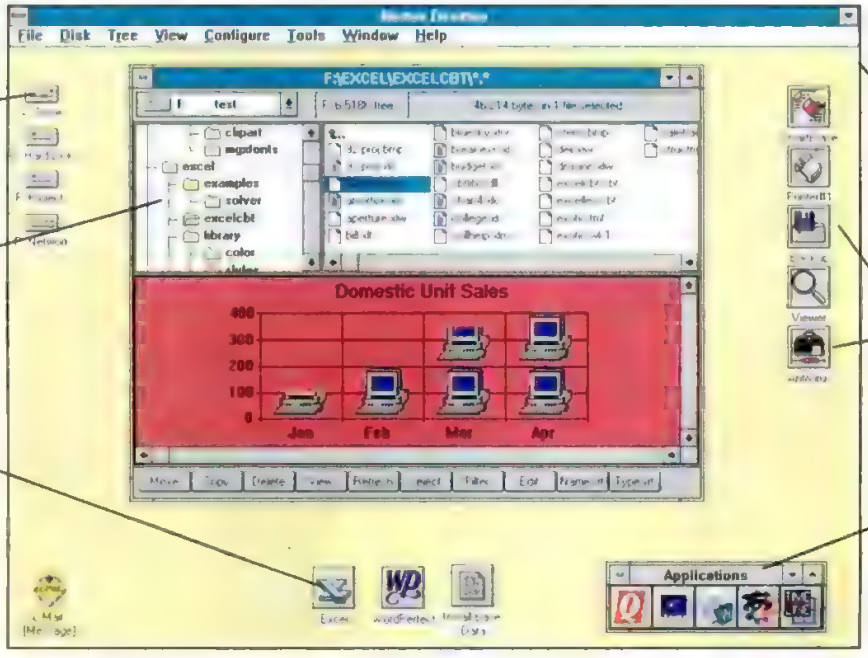

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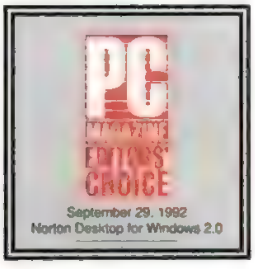
We all know time is money. And because Norton Desktop looks so much like Windows, you won't have to waste time learning how to use it. You get most everything you need to run your PC in one comprehensive package — a great, money-saving value.



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Because Norton Desktop can be easily customized, you invest your energy in your work, not in trying to figure out how to get it done. Customizable auto-load frees you from reloading applications that you use daily. And, SuperFind™ allows you to locate "lost" files, across networks or in the background.

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Are You Talking to Me?

Workgroup apps to enhance collaboration.

The blossoming low-end LAN market—and Microsoft's recent foray into it with Windows for Workgroups—promises to intensify the demand for applications that make it easy to share information over networks. Today, there just aren't many applications that are workgroup-ready. For example, it's not at all easy to have more than one person at a time working on a spreadsheet or editing a document. But next year Borland, Lotus, Microsoft, WordPerfect Corp., and many others will release workgroup-enabled applications that will make collaborating with your colleagues easier.

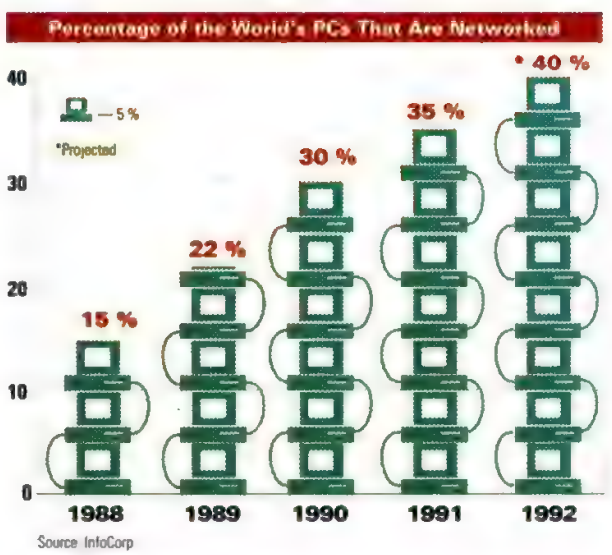
In the simplest terms, workgroup computing means applications have built-in e-mail capabilities. From within an app, you can mail a document to someone else on the network just by selecting Send from a menu. On a more complex level, workgroup computing means a collaborative sharing of your document, schedules, and databases with others.

Lotus, which virtually invented the workgroup category four years ago with Notes, already includes e-mail hooks in Version 1.1 of 1-2-3 for Windows. In Version 2.0 (due shortly), Lotus plans to incorporate a more advanced work-group technology (code-named Chronicle) that will allow multiple contributors to the same spreadsheet. In 2.0, a worksheet file will be annotated with the e-mail names and addresses of whoever worked on it, as well as a date and time stamp for audit purposes. (For more information on Chronicle, see Trends, April 14, 1992.)

Microsoft is developing a workgroup-enabled version of Excel that will let you mark a range in your spreadsheet that you want filled in by someone else. You choose Delegate Range from the Formula menu, pick a name to send to by e-mail, and send the range. Your coworker receives the range, adds the numbers, and chooses Return to

Continues on page 32

Working Together



As more PCs get networked, the demand for workgroup applications will rise.

Silent No More

WHAT BEGAN AS A MURMUR IS becoming a cacophonous din. Computing with a PC is about to become a lot noisier.

Sound has always been an important element in games, but much less so in business applications. Earlier this year Compaq put what it calls Business Audio into its Deskpro I and M series, and Microsoft recently released an add-in board called the Windows Sound System. Both products use the same software (Compaq licensed it from Microsoft), which provides voice annotation for documents, spreadsheet proofreading, and simple voice recognition.

Following ATI Technologies' year-long lead with its Stereo FX (video from the VGA Wonder XL combined with 8-bit audio), video board makers Orchid Technologies and Sigma Designs are putting sound chips on their graphics adapters. Orchid Technologies' Fahrenheit VA is an S3-accelerated board with stereo output jacks, a microphone, and a Windows applet that lets you add sound "Post-it" notes to applications.

Sigma Designs' WinStorm uses a Cirrus Logic chip set for video, a 16-bit Media Vision audio chip set, and comes bundled with three multimedia applications. WinStorm also has SCSI and MIDI connectors.

Next year sound chips will be built into the motherboards. ESS Technology, maker of the Disney Sound Source, is manufacturing an inexpensive chip that many system vendors will integrate by the middle of next year. Enjoy the silence while you can.

—Christopher Barr

Multimedia, IBM Style

IBM CORP. HOPES TO MAKE ORDER out of the chaos in the multimedia market, and its proliferation of complex and incompatible products. IBM's two-pronged strategy of standardization and exhortation is designed to do for the Ultimedia PS/2 what the Multimedia PC (MPC) did for Microsoft: make it the multimedia platform of choice.

Pipeline *By Robin Raskin*

Microsoft at the Movies

When Microsoft ships the $199 Video For Windows in November, we'll see the first embodiment of the software giant's digital video strategy. Video for Windows is a set of tools that lets you create, edit, and integrate video into Windows applications. Playing with Microsoft's movies won't require additional hardware—unless you're involved with capturing images.

The quality of Microsoft's software-only video is anywhere from reasonable to very good, depending on the power of your hardware platform and the screen and color resolution of your video image. The video will look best played in a one-quarter-screen window; full-screen video looks rather coarse.

Installed as its own program group under Windows, two tools, VidEdit (for editing) and VidCap (for capture) form the heart of Video for Windows. A couple of lesser tools—clip-art video images, and a trio for working with bitmaps, color palettes, and digital audio files—allow further explorations. Ultimately, these tools should work their way into the mainstream Windows environment in the same way that Windows' audio capabilities were introduced in the Multimedia Extensions for Windows 3.0 and then incorporated into Windows 3.1.

Microsoft's biggest competitor—and Microsoft's role model—is Apple's QuickTime. In addition to playing back digital frames at reasonable animation rates, Apple figured out a way to subtract frames as necessary so that sound and animation were synchronized on playback. Early AVI technology (Microsoft's Audio Video Interleave is the file format for Video for Windows) lacked this, but the current implementation includes synchronization that is every bit as good as Apple's. Still, rather than take on QuickTime headlong, part of Microsoft's Video for Windows strategy includes a technique for converting QuickTime movies so they can be played back under Windows.

Microsoft hasn't ignored other emerging video standards, such as Intel's Digital Video Interactive (DVI), either. The most clever part of Video for Windows is that it is a wide-open technology. All a third party needs to do is "talk" to the newly "revamped-for-video" Media Control Interface (MCI). (The new MCI also adds Object Linking and Embedding server capabilities so you can paste snippets of video into spreadsheets and documents.)

Video for Windows will include compression/decompression tools (codecs) that automatically recognize and play Indeo (Intel's codec for playing DVI) as well as Microsoft's Run Length Encoding (RLE), a good format for running on less able machines like 286s and consumer systems such as Tandy's Video Information System (Pipeline, November 24, 1992.)

With both DVI and QuickTime embraced, two of the standards most likely to have given Microsoft a run for the money become opportunities rather than threats. But don't expect Video for Windows to be an overnight blockbuster. Even though it is theoretically a fully scalable environment, early beta-testers caution that anything less than a powerful 486 with plenty of horsepower is inadequate for running video. And judging from the slow rate of adoption of sound in mainstream business, you're unlikely to see a rash of office video memos anytime soon.

PHOTOGRAPH BY PETER DIRE

Robin Raskin is an executive editor of PC Magazine.

Prong one consists of the IBM Ultimedia Tools Series (UTS) architecture, whose stated purpose is "to provide a consistent and cooperating set of multimedia tools for developing multimedia application solutions." In practice, this means that compliant applications running under DOS, Windows, or OS/2 will look and act as similarly as possible; this is because of required Common User Access and OS/2 Workplace Shell support and similar installation procedures, along with the ability to exchange a core set of metafile and multimedia file formats.

Low-key evangelism forms the second prong of IBM's strategy. The company has invested in a reseller, MediaSourcery Inc., which will market, distribute, and support all Ultimedia Tools Series products. While you might think that software vendors would balk at a reseller pitching their competitors' products as well as their own, so far there have been no complaints. Companies such as AimTech, Asymmetrix, Autodesk, Gold Disk, Macromedia, and ZSoft have already thrown in their lot with IBM.

The UTS architecture doesn't mandate *how* an application accesses sound and video hardware, which is usually done via Windows' or OS/2's Multimedia Extensions or via proprietary drivers under DOS. But, in traditional IBM style, the UTS architecture does mandate that any compliant application must run under OS/2, either as a native OS/2 application or in a DOS or Windows box. Compliance with the architecture requires that applications must, at minimum, be able to run on an IBM PS/2 M57 SLC Ultimedia system, and presumably all future hardware specifications will be based on IBM or Micro Channel peripherals. In direct contrast to the Multimedia PC Marketing Council (which does not test products carrying its logo but does charge a licensing fee to software developers), Media-Sourcery will test all software for compliance, and apps will bear the UTS logo free of charge.

The UTS architecture is a sensible move for IBM, but its success will be limited because it ignores the plethora of multimedia peripherals available for the Industry Standard Architecture (ISA) bus. While IBM is not averse to bringing the UTS architecture up as a standard, for now it's just another brick in the wall. —*Lori Grunin*

IBM Ultimedia Tools Series Framework

Multimedia apps that comply with IBM's new Ultimedia Tools Series (UTS) architecture will look and act similarly, thanks to required Common User Access, OS/2 Workplace Shell support, similar installation procedures, and the ability to exchange a core set of metafile and multimedia file formats.

Personal Communicators

IMAGINE RECEIVING AN E-MAIL message from a software developer telling you the latest upgrade to your application is attached. To get the upgrade, simply press the install button that is embedded in the message. Sound farfetched? Well, next year GO Corp.'s 32-bit pen-based operating system, PenPoint, will make this possible through GO Mail and AT&T's EasyLink Services.

Getting a painless upgrade is only a hint of how PenPoint is evolving into an operating system for future personal communicators. GO's partnership with AT&T extends PenPoint from traditional fax and modem capabilities to ubiquitous communications by connecting to LANs, public e-mail networks, voice-mail, and all manner of wired and wireless information providers.

EO Inc. plans to use a special version of PenPoint, which was written specifically for its AT&T Hobbit microprocessor, on a line of mobile personal communicators. EO, which is Latin for *to go*, teamed up with AT&T to target business users who need to stay in touch with more than just a telephone. In addition to the Hobbit CPU, AT&T is contributing digital signal processing technology for voice recognition.
—*Christopher Barr*

Top Retail Software

Current ranking	Last issue	Product Company
1	7	**WordPerfect 5.1 for Windows** *WordPerfect Corp.*
2	3	**QEMM-386 6.0** *Quarterdeck Office Systems*
3	2	**Microsoft Windows 3.1 Upgrade** *Microsoft Corp.*
4	4	**Microsoft Windows 3.1** *Microsoft Corp.*
5	5	**Microsoft DOS 5.0 Upgrade Kit** *Microsoft Corp.*
6	9	**Procomm Plus 2.01** *Datastorm Technologies*
7	6	**Quicken 6.0** *Intuit*
8	11	**Word for Windows 2.0 Upgrade** *Microsoft Corp.*
9	—	**WordPerfect Windows Trade Up** *WordPerfect Corp.*
10	—	**Procomm Plus for Windows 1.01** *Datastorm Technologies*
11	12	**Word for Windows 2.0** *Microsoft Corp.*
12	13	**Lotus 1-2-3 2.4** *Lotus Development Corp.*
13	—	**PC Anywhere 4.5** *Symantec*
14	—	**Lotus 1-2-3 for Windows 1.1 Upgrade** *Lotus Development Corp.*
15	1	**WordPerfect 5.1 for DOS** *WordPerfect Corp.*

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending October 3, 1992. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information compiled by Ingram-Micro.

Intel Index Compares CPUs

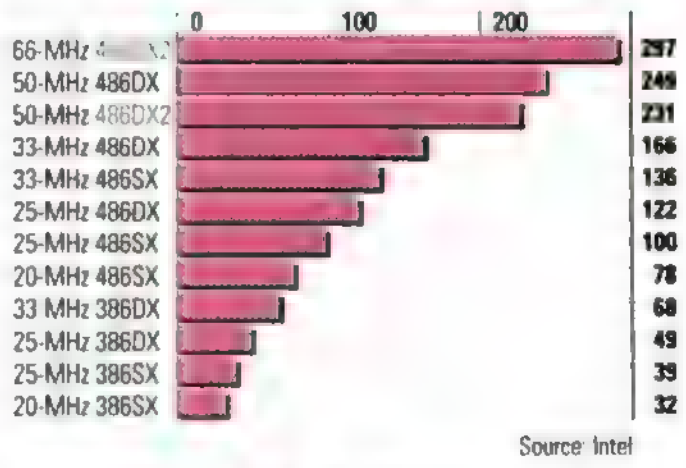
WHICH INTEL CPU IS MORE POWERful: A 25-MHz 486DX or a 33-MHz 386DX? While *PC Magazine* readers know the correct answer, according to the company's research, many of Intel's customers aren't sure that a 25-MHz 486 beats a 33-MHz 386.

Customer confusion over chip choices will only get worse as system vendors increase their efforts to target home buyers, who are often less technically savvy than business customers. And Intel's own ambitious product plans—CEO Andy Grove has promised to deliver more than 30 new chips over the coming year—mean there will be even more performance levels for consumers to sort out.

To solve the problem, Intel has created a CPU performance index called iCOMP. The iCOMP rating provides a single number to indicate the relative performance differences among the company's CPUs. The bigger the number, the faster the processor. To use our original example, the iCOMP index will let the unsophisticated buyer see quickly that a 25-MHz 486DX (with a rating of 122) is faster than a 33-MHz 386DX (with a rating of 68).

Although the iCOMP index uses a variety of benchmark tests (including our own ZD Labs' CPU mix), it does not replace them. Benchmark tests will show you which machine in a processor class performs better; the iCOMP rating can only tell you which Intel processor class is faster.

The current iCOMP index is made up of four weighted components: 16-bit integer (67 percent), 16-bit floating point (3 percent), 32-bit integer (25 percent), and 32-bit floating point (5 percent). Those weightings reflect Intel's best guess about the importance of each component in applications over the next three to five years (the average system lifetime). But Intel expects to update the formula as new CPU capabilities emerge (graphics and video are two likely candidates), and as applications change (as more of them take advantage of 32-bit technology, for example).



Intel's new iCOMP lets the unsophisticated buyer see quickly that a 25-MHz 486DX (with a rating of 122) is faster than a 33-MHz 386DX (68).

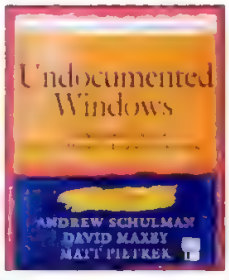
Clearly, the iCOMP ratings will be most helpful in the mass merchandise channels, but how they will be used there isn't so clear. To educate consumers, Intel might do well to adapt its successful "Intel Inside" marketing style to iCOMP, but the company currently has no plans to do so. And while system vendors, such as Dell, which had been briefed on iCOMP, seemed receptive to the concept, they didn't have specific marketing plans for it.

The iCOMP index is certainly a good idea, and a big step in helping the uneducated public pick the right CPU. But Intel's plans—and interests—are confined to its own chips. To make the iCOMP index more useful, it should be extended to allow comparisons among Intel clone CPUs, such as those from Advanced Micro Devices and Cyrix, and the new generation of RISC processors, such as Digital Equipment Corp.'s Alpha chip.—*Mary Kathleen Flynn*

Undocumented Windows Calls

DESPITE THE COMPLAINTS OF COMpetitors who say that applications developers at Microsoft Corp. have an unfair advantage when it comes to getting information about undocumented Windows functions, the computer industry has yet to uncover a smoking gun—that is, an undocumented call that lends a significant edge to a Microsoft application.

PC Magazine readers were first alerted to the existence of undocumented functions in the Windows application programming interface (API) when Andrew Schulman discussed it in Lab Notes (January 28, 1992). The rest of the world heard about the controversy when articles appeared in the mainstream business press after the August publication of *Undocumented Windows* (Addison-Wesley), written by Schulman, David Maxey, and Matt Pietrek. While these articles may have lent ammunition to the Federal Trade Commission's investigation of Microsoft's alleged anticompetitive behavior, they did little to explain why undocumented Windows calls exist and how they are used. And few pointed out that Windows is much more thoroughly documented than DOS has ever been, or that the documentation for IBM's OS/2 Presentation Manager is full of inaccuracies and descriptions of functions that aren't implemented (the opposite of Microsoft's problem).



Many of the Windows calls that aren't documented were designed for internal-operating-system use only. Most exist to handle communications among the three major dynamic link libraries of Windows: the kernel, the user interface, and the Graphics Device Interface (GDI). Others are used by device drivers, such as the PrestoChangoSelector call that switches a memory segment between data and code—and was eventually documented in Windows 3.1. Still others are used by the Windows Task Manager, Program Manager, and File Manager.

It turns out that some of the undocumented calls provide benefits for specialized applications. Symantec's Norton Desktop and other shell replacements, for example, use some of the Task Manager calls. As Schulman points out, the GetTaskQueue function is useful for interactive development environments. Although Microsoft may have originally regarded this call as obscure, the company's own Quick C for Windows relies on it to determine whether a launched program is ready to receive messages.

But for most mainstream apps, the 1,000-plus documented Windows calls are probably sufficient. To date, no one has found a Microsoft app that gets a significant advantage from an undocumented function—such as, for instance, a text output function that is faster than the documented ones (although Microsoft could certainly outline the performance variations among the existing text output functions more explicitly). Microsoft recently vowed to document any and all functions used in its applications.

Exploring undocumented calls is a great way to learn about the inner workings of Windows, but it just doesn't provide the proof of Microsoft's misconduct that some have been seeking. However, Microsoft faces an uphill battle when it comes to demonstrating that all Windows developers (even its own app groups) are on a level playing field. Further documenting Windows could go a long way toward smoothing competitors' ruffled feathers. (For more on Microsoft's relationships with its developers, see Michael J. Miller's column in this issue.)—*Mary Kathleen Flynn and Charles Petzold*

Briefs

IN ONE OF ITS FINAL ACTS, THE 102ND Congress elevated commercial software piracy from a misdemeanor to a felony, raising the maximum penalty from $25,000 to $250,000 and five years in jail. Piracy cost the worldwide computer industry more than $12 billion in lost revenues last year, according to the Business Software Alliance. The Software Publishers Association has been fighting back aggressively—it recovered more than $3 million during its fiscal year—as has Microsoft, which led the largest counterfeit software seizure in history when U.S. Marshals took $9 million worth of fake MS-DOS 5 packages from U-TOP Printing Corp. (To report pirates, call the SPA at 800-388-7478, or Microsoft at 800-662-6796).

UNTIL NOW, NETWARE USERS HAD TO pay between $1,300 and $2,500 to get a LAN server–based backup package more sophisticated than SBACKUP (the utility that comes with Novell's NetWare 3.11). But Sytron Corp.'s new Server Backup Plus costs $395. Wangtek and WangDAT (both of which are owned by Sytron's parent company, Rexon Inc.) are bundling the software in with their new NetWare-Ready Tape quarter-inch cartridge and DAT drives.

PUBLIC-ACCESS COMPUTERS ARE becoming more common. For example, the 200,000 veterans expected to participate in the 10th Anniversary of the Vietnam Veterans Memorial in Washington D.C. this fall can use public terminals to help them locate lost friends through a networked database. The effort was led by Re*Union '92 and Electronic Data Systems, and included products donated by AST Research, Fujitsu, Maxtor, Microsoft, and Sun Microsystems. —*Mary Kathleen Flynn*

Talking to Me?

CONTINUED FROM PAGE 29

Sender from the Excel menu to return it directly to your spreadsheet. When the range comes back, you choose Delegate Range from the Formula menu and select the Merge command to have it written back to your version. These features will be available next year as an add-on to Excel, and workgroup features such as these will be incorporated into the next release of Excel.

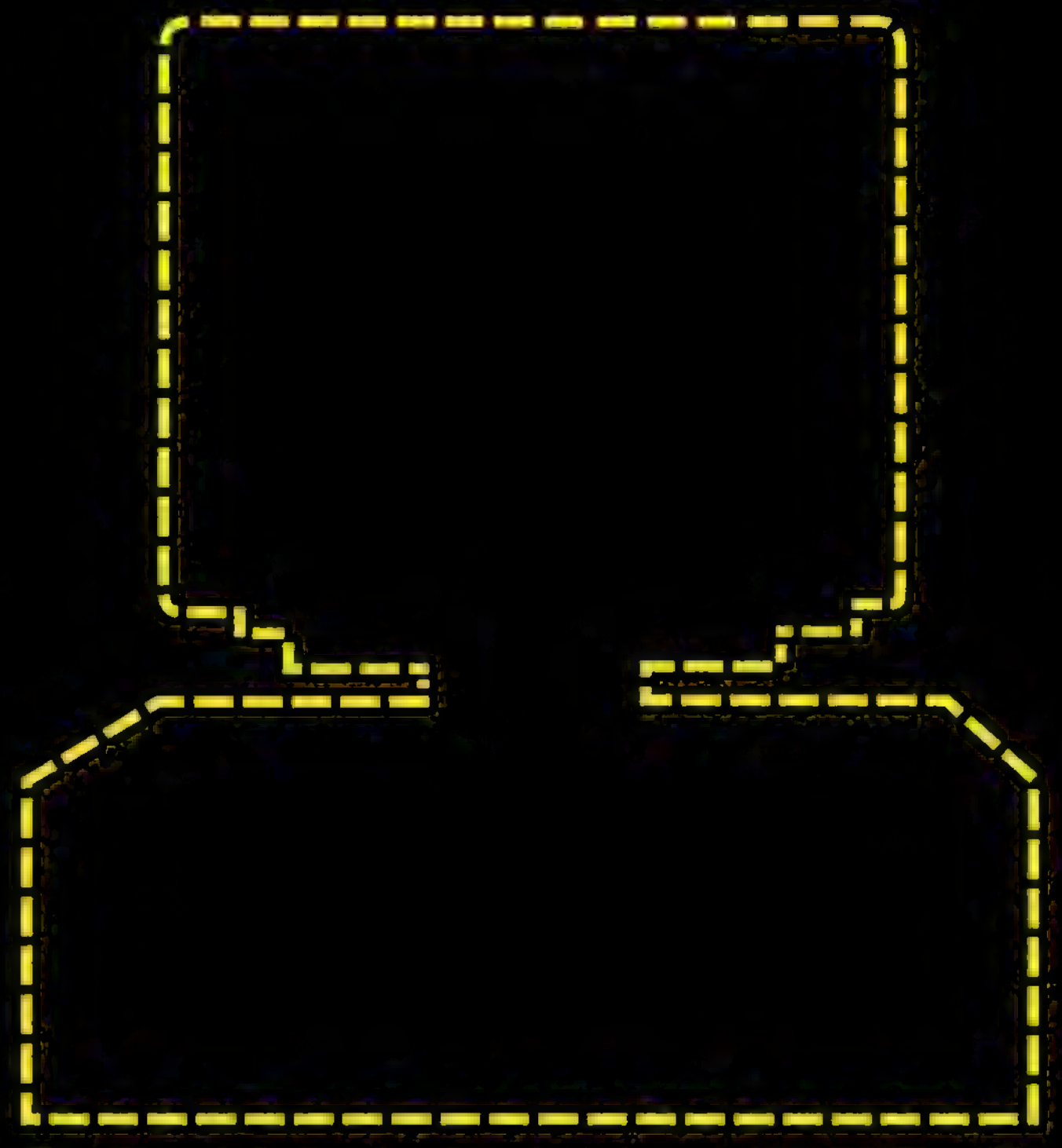
In workgroup word processing, Microsoft is playing catch-up to Lotus, which provides e-mail hooks to Ami Pro 2.0 and 3.0 users who have CC:Mail or Notes. Microsoft's new Version 2.0B of Word for Windows (a free upgrade) adds e-mail hooks, including a Send Mail command to the File menu.

Later this year, Microsoft's Visual Basic, Version 2.0, will provide new tools to develop e-mail- and workgroup-enabled applications.

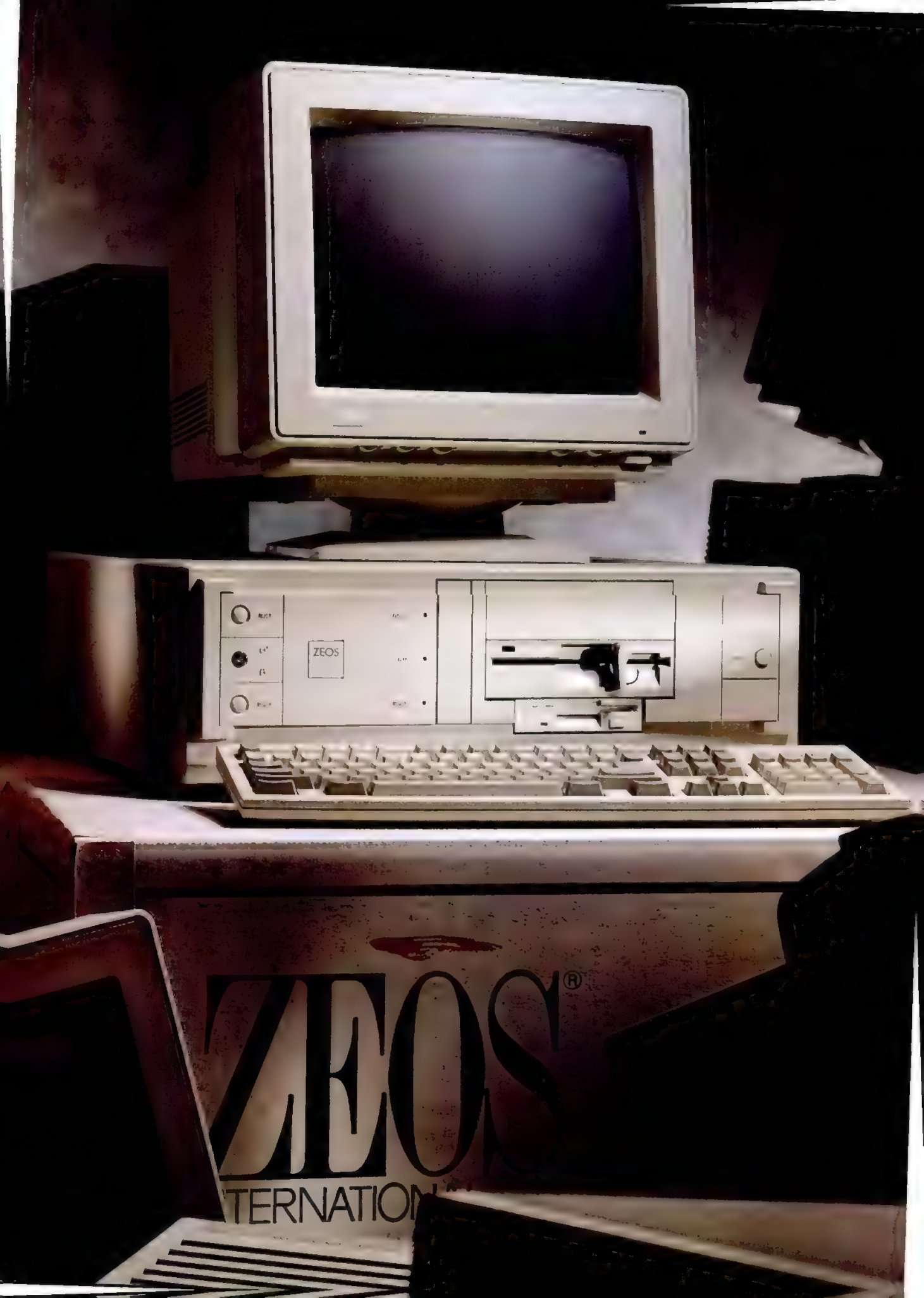
But Microsoft and Lotus will not be alone in delivering workgroup-enabled apps. WordPerfect Corp. plans to implement both Microsoft's Messaging Application Programming Interface (MAPI) and the Vendor Independent Messaging (VIM) API sponsored by Borland, Lotus, and others into future versions of WordPerfect (both DOS and Windows products). And Borland has ambitious plans to make all its applications workgroup enabled with an architecture called OBEX (for Object Exchange). The details (and product schedule) are still sketchy, but OBEX will allow apps to share data with people and with other apps.

The one dark cloud over the industry's rosy vision of workgroups is that MAPI and VIM are still not compatible. Executives from both Microsoft and Lotus have said that making the two talk to each other is trivial. Now is the right time for them to make it happen.—*Christopher Barr*

When everyone else
is trying to cut prices
by giving you less...



It's nice to know
someone is cutting prices
and giving you more.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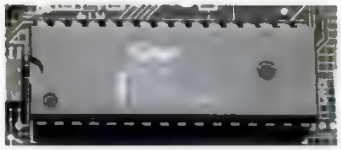
TERNATION

ZEOS Gives You More. For Less!

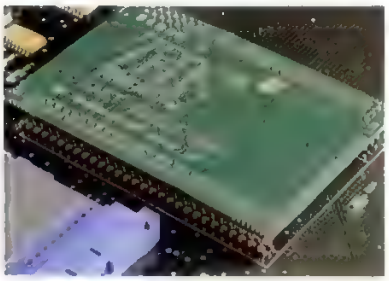
No doubt about it. It seems that everyone else in the computer industry is trying to cut prices by giving the customer less. Not so at ZEOS. We're cutting prices and giving you more! How are we doing it?

For starters, we've completely redesigned our line of upgradable motherboards. Utilizing the very latest technologies, these new systems offer you more power and upgradability than anything else you can buy. We've also reconfigured our standard package offerings, giving you even more, for less!

So come on in and take a look at the new ZEOS PCs. They're simply the best deal going. You'll love 'em. Call today!



Flash BIOS enables you to easily implement BIOS upgrades via modem or disk.



You can upgrade your system now or in the future with our optional 128K or 256K secondary cache modules.

about your high-speed memory expandable to 64MB. Mention your fast IDE HDD controller and your hard drive with its own built-in cache. Then talk about the other ZEOS performance options. Like your upgradable high-speed cache!

THE CACHE OPTION IS YOURS.

Because painfully missing from many competitors offerings is the option for a secondary cache. With ZEOS you can add a secondary cache of 128K or 256K. This speeds up many memory intensive applications. Take it now or add it later if you wish. ZEOS gives you the option. And that's just for starters.

ON BOARD SCSI IF YOU WISH!

Because your new ZEOS upgradable offers you the additional option of on board SCSI. By simply adding a single socketed SCSI chip to

erformance.

the board your new ZEOS system supports both SCSI I and SCSI II type devices. You can now have SCSI hard drives (running *in addition* to your standard IDE drives) plus tape backups, optical drives and a host of other SCSI peripherals. Take it now or add it later. Only from ZEOS.

#1 IN EXPANDABILITY & RELIABILITY!

Of course power and expandability are ZEOS hallmarks. In their haste to cut features and to cut prices it would seem the others have forgotten about your future. That's why ZEOS has things like *eight* expansion slots, *high-capacity* power supplies and *seven* drive bays all in our standard SpaceSaver desktop cases. We care about you and the long-term ownership of your new computer. We invite comparison. The more you look, the more obvious your ZEOS advantages become.

Like the two cooling fans you'll find in every ZEOS system. While ZEOS systems run cooler than most with *one* fan we still give you *two whisper-quiet cooling fans.* The cooler your system runs the longer it will last. We also include a *built-in surge suppressor* in every system. It's all part of ZEOS' built-in Award Winning reliability. Of course every ZEOS system carries the Underwriters Laboratories listing as well. These are extra features the others *can't* or *won't* offer you. From ZEOS, they're yours. No additional charge.

FREE LOTUS SOFTWARE TOO!

And don't forget, when you purchase any new ZEOS Windows based system, you will also receive your choice of two: *Lotus 1-2-3 for Windows, Ami Pro,* and *Freelance Graphics.* You're going to love it. The software alone carries a suggested retail price of over $1,000 and we're giving it to you *absolutely free.* Now that's ZEOS Value.

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Remember too, ZEOS provides you with our top-rated 24-Hour-a-Day Toll-Free Technical Support. *Plus* your new ZEOS system is covered by our 30-Day Money-Back Guarantee, One Full Year Limited Warranty, and our Express Parts Replacement Policy.

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There is no question. While everyone else is cutting prices by giving you less, ZEOS is cutting prices and giving you more. Whether you choose the 486SX-25, the amazing 486DX2-66 or anything in between—*ZEOS gives you the most for your money.* So go ahead and give us a call.

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Ordering your new ZEOS upgradable system is easy. Simply pick up the phone and give us a call. A friendly and knowledgeable ZEOS Systems Consultant is ready to answer any questions you may have. You're going to love your new ZEOS system. *Why not give us a call right now!*

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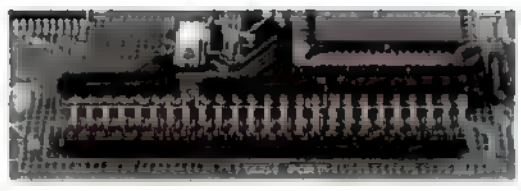
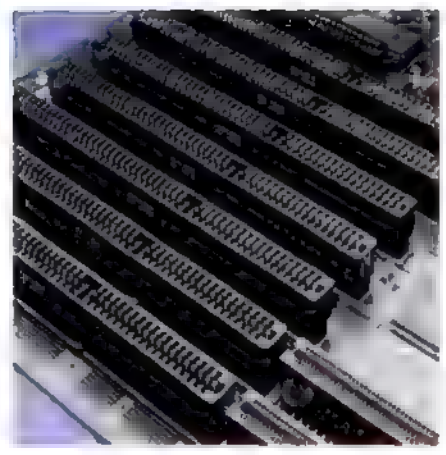
LPGR8P PCM 9211B

ZEOS systems feature award winning reliability and support. Nine times PC Magazine's *Editors' Choice.*



The on board SCSI option lets you add SCSI I or II devices anytime. SCSI hard drives, opticals and more are easy to add.



Eight expansion slots provide you with plenty of room to add to your system in the future.

Pick Your Power!

ZEOS Complete System Package #1

- Your choice of CPU with upgrade options. Our Zero Insertion Force (ZIF) upgrade socket makes it easy.
- 2MB of high-speed RAM expandable to 64MB on board.
- 85MB high-speed IDE hard drive with built-in cache.
- 1.2MB or 1.44MB Teac® FDD.
- ZEOS 14" Hi-Res mono VGA monitor with 1MB high-speed VESA Local Bus card.
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- Two serial and one parallel port.
- Shadow RAM/ EMS support.
- Optional SCSI port (plug-in chip) for SCSI I & II devices including hard drives, tape drives, optical disks and more.
- Upgradable high-speed cache options of 128K and 256K.
- Flash BIOS for easy BIOS upgrades via disk or modem.
- High-capacity power supply with built-in surge suppression.
- Rugged ZEOS SpaceSaver case with seven drive bays and two cooling fans for added reliability.
- ZEOS RS/101 key tactile/click keyboard, double injection key caps with Alps keyswitches.
- Microsoft DOS Version 5.0.
- Includes ZEOS 24-Hour-a-Day Toll-Free Technical Support, 30-Day Money-Back Guarantee, Customer Satisfaction Package.

486SX-25
486SX-33
486DX-33
486DX2-50
486DX2-66

Incredible ZEOS Package #2

We take package #1 and add more memory, a bigger drive, both floppies plus Windows, a MS Mouse *and* your choice of two Lotus Windows software applications, free!

- Your choice of upgradable CPU.
- 4MB of RAM expandable to a system total of 64MB.
- Our 130MB high-speed IDE hard drive with built-in cache.

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- Microsoft DOS, Windows and a genuine MS Mouse, your choice of two out of three Lotus applications for Windows: Lotus 1-2-3 for Windows, Ami Pro, and Freelance Graphics.

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There's not another system like it anywhere! Memory goes to 16MB, your drive up to 340 Megabytes. No-body can touch it. This baby's hot!

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- 16 full megabytes of blazing RAM.
- Our screaming 340MB IDE HDD.
- Both Teac® floppies.
- ZEOS 14" Hi-Res 1024 x 768 non-interlaced VGA color monitor with 1MB high-speed VESA Local Bus card.
- Microsoft DOS, Windows and a genuine MS Mouse, your choice of two out of three Lotus applications for Windows: Lotus 1-2-3 for Windows, Ami Pro, and Freelance Graphics.

Fast 36-bit memory SIMMS provide you with optimum flexibility supporting up to 64 megabytes on the motherboard.

ZEOS gives you two local bus slots designed to the VESA standard, capable of local bus mastering.

ZEOS systems carry the most demanding safety listings including the Underwriters Laboratories (UL) listing on the entire system.

Get 66MHz Power. Now!

It starts with the desire to own one of the fastest PCs in the world. It's a thirst to have the very best money can buy. But there is always the question of money. How much for how much?

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From ZEOS you get more for less, *absolutely.* If power, capacity, speed and upgradability are what you're after, the ZEOS 66MHz '486 is the one for you. We've put together some incredible new money-saving system packages for you. Take a look.

Right now you can get into the ZEOS '486 66MHz for as little as $2195. And power users can step right up to even more savings. With *standard packages* featuring up to 16 megabytes of memory and drives to 340 megabytes. Plus, ZEOS offers more options than probably anyone else in the business.

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Consider the Vertical Option. We can build your new upgradable system in our eight-bay vertical case. It comes complete with our high-capacity power supply and two cooling fans. Add only $95.

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So for incredible '486 66MHz power, complete compatibility *plus* award-winning reliability and support—give us a call. You're going to be *very satisfied.* And that's a guarantee! Call now toll free: 800-423-5891.

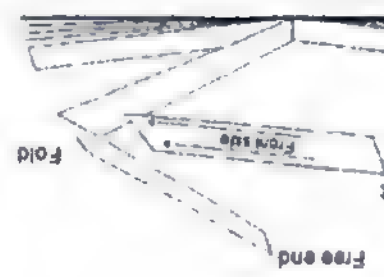
intel inside

Folded edge of the page

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

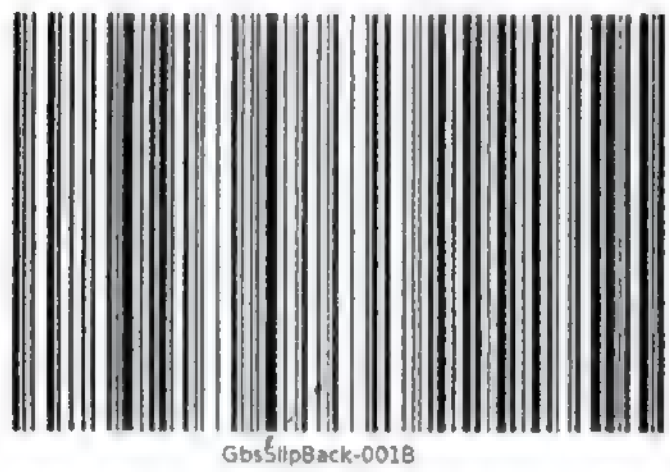


Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

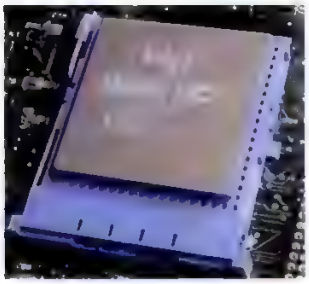
Inverted Back

1. Follow instructions on the other side



Back

1. Follow instructions on the other side



Pick your power! 486SX-25 thru the 486DX2-66. And upgrading is easy with our Zero Insertion Force (ZIF) socket. Note the extra row of pins for the future OverDrive™ CPU based on Intel's P5 technology.

When you buy any ZEOS Windows system you can choose 2 of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro and Freelance Graphics for Windows!

New ZEOS® PCs!

Your new ZEOS upgradable system leaves everybody else in the dust. Just run the benchmarks and the others turn green with envy. But we don't just stop with PCs that are among the fastest in the world.

You simply get more. For less. When everyone else started cutting prices by giving less, ZEOS had a better idea – Use the very latest technology to design an entirely new line of high performance upgradables that allow us to *charge less while giving more.* You're going to love it!

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By using the very latest in 486 chip set technology we have been able to incorporate more new features than ever before.

TWO VESA STANDARD LOCAL BUS SLOTS.

While the others are talking about local bus, often creating their own non-standard solutions, ZEOS gives you a VESA future. As a working member of the VESA Standards Committee, ZEOS has incorporated *two* slots conforming to the recently established VESA standard.

More Features. Greater Pe

ZEOS. THE UPGRADABLE EXPERTS.

Nobody knows upgradability better than ZEOS. After all, ZEOS was one of the first to introduce truly high performance upgradable PCs. Now using the latest in high integration technology we've made a good thing even better, right up to the 486DX2-66 and beyond.

How far beyond?

Try the future OverDrive™ processor based on Intel's P5 technology! Start today with the '486 CPU of your choice. Select between the 486SX-25 or 33, the 486DX-33, the 486DX2-50 or the 486-DX2-66. Then, in 1993, you'll be able to add the new super processor (you'll note the extra row of pins around each side of your CPU upgrade socket, that's what they're for). Maximum power today *and* tomorrow. When we talk power we're talking speed.

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What does this mean to you?

Unparalleled VESA local bus performance! We've taken one of your two VESA local bus slots (which can also be used for standard 16-bit cards if you wish) and added a *screaming* local bus video card. Windows has never moved so fast! And with our bus mastering capability, a second local bus card can be added in the future as well. ZEOS gives you more performance options than anyone else. *Take a closer look!*

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With ZEOS, performance enhancements are standard. If you have a technical bent you'll love reading about them. If you're a typical user, just tell your friends your new ZEOS system has these things. They'll be impressed. Like what?

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- Flash ROM BIOS.
- High-capacity power supply with built-in surge suppression.
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- ZEOS RS/101-key keyboard.
- Microsoft DOS, Windows and a genuine MS Mouse, your choice of two out of three Lotus applications for Windows: Lotus 1-2-3 for Windows, Ami Pro, and Freelance Graphics.
- Includes ZEOS 24-Hour-a-Day Toll-Free Technical Support, 30-Day Money Back Guarantee and Customer Satisfaction Package.

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Please complete all appropriate sections, *providing at least two years residence and employment history. THIS IS NOT A CREDIT AGREEMENT!* One will be sent to you upon authorization of an account. (This form must be signed to process your application.) All financed purchases are subject to credit approval. *If you have any credit questions, please call 800-421-8942 for assistance.* Thank you!

Name _____ Previous Address _____

Home Phone (____) _____ City _____ State _____ Zip _____

Soc Sec No _____ Date of Birth ___/___/___ Employer _____ Since? (Mo./Yr.) _____

Address _____ Apt _____ Monthly Gross Salary $ _____ Daytime Bus. Phone (____) _____

City _____ State _____ Zip _____ Previous Employer _____ From _____ To _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____ Occupation _____

A married person may apply for individual credit. I am applying for (please check appropriate box):

☐ **JOINT CREDIT** with another person. Complete entire application.

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.

☐ **INDIVIDUAL CREDIT.** Do not complete section C.**

** If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS:
YOU MUST DISCLOSE YOUR MARITAL STATUS
☐ married ☐ unmarried ☐ legally separated

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income $ _____ Source _____

Name & Address of Nearest Relative Not Living With You _____

_____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE A

Checking Account ☐ Yes ☐ No
Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	___	_____	Dept Store Charge Card	___	_____
VISA	___	_____	Credit Union Account	___	_____
MasterCard	___	_____	Other Major Charge Cards	___	_____
Finance Company Loan	___	_____			

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc Sec No. _____ Date of Birth ___/___/___

Address _____ Apt _____

City _____ State _____ Zip _____

Home Phone (____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (____) _____ Monthly Gross Salary $ _____

CUSTOMER AUTHORIZATION

I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief.

Applicant's Signature _____ Date _____

Joint Applicant's Signature _____ Date _____

FOR MARRIED WISCONSIN APPLICANTS: I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

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There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 800-421-8942 or 612-635-0613 or write to ZEOS, Z-Card Processing Center, 530 5th Avenue N.W., St. Paul, MN 55112.

NY–A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

OH–The Ohio laws against discrimination require that all creditors make credit equally available to all creditworthy customers and that credit reporting agencies maintain separate credit histories on each individual upon request. The Ohio Civil Rights Commission administers compliance with this law.

*Financing not available in Alaska, Hawaii or outside the continental U.S.

ZCDJT-PCM-9212A

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You can apply for your very own Z-Card and low, low monthly payments right now. Simply fill out this application and fax it to 612-633-7507. Or mail it to ZEOS International, Z-Card Processing Center, 530 5th Ave. NW, St. Paul, MN 55112. We'll contact you as soon as your credit line is established, usually within 24 hours of receipt. Apply today!

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- 5.6 pounds

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TEXAS INSTRUMENTS

*Manufacturer's Suggested Retail Price. Dealer prices may vary

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CIRCLE 026 ON READER SERVICE CARD

First Looks

HANDS-ON EVALUATIONS OF THE NEWEST SHIPPING PRODUCTS

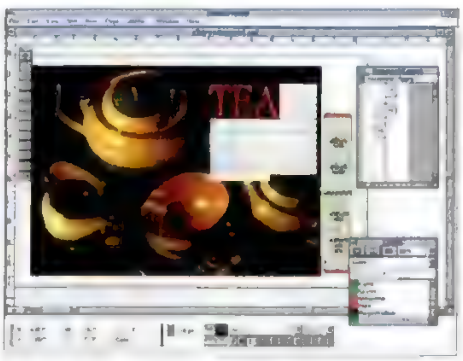
A Mac Classic Comes to the PC

QuarkXPress for Windows Breaks New Ground in DTP

BY LUISA SIMONE

QuarkXPress for Windows boldly goes where no PC-based desktop publishing program has gone before. This $895 program, a classic on the Macintosh platform, addresses the specialized needs of professional art directors and tackles the thorny problems of commercial printing processes.

QuarkXPress targets a specific user—the professional art director who needs to produce tight layouts quickly and efficiently. Toward that end, seven floating palettes (Tools, Style Sheets, Colors, Document Layout, Measurements, Trap Information, and Libraries) provide powerful design tools and robust document management functions.



TOTAL CONTROL: *Quark's distinctive Measurement palette offers quick, precise controls.*

For example, most desktop publishing programs supply two Master pages (for left- and right-hand pages) that contain repeating elements. Quark's Document Layout palette lets you create up to 127 different master page layouts. Suddenly, creating a complex document under deadline pressure becomes a manageable task. The Document Layout palette serves double duty by providing a schematic representation of your publication so you can easily navigate long documents.

This emphasis on efficiency also explains the Library palette, which gives you quick access to frequently used images and design elements.

But Quark's palettes are only one way to access the program's functions. If you prefer an uncluttered screen, you can use menu commands to determine such measurements as an object's precise size, exact *x* and *y* coordinate location, and the degree of rotation.

ADVANCED TYPOGRAPHY

A lot of attention has been given to Quark's phenomenal typographic abilities. QuarkXPress can scale both type and leading in .001 point increments, and can control either kerning or tracking by 1/20,000 of an Em. It's important to note that neither the human eye nor state-of-the-art imagesetters can resolve this level of detail, but these exceptional statistics confirm the program's precise and robust nature.

Quark offers many other impressive typographic controls that are of more practical use to art directors. For example, you

• *Continues on page 40*

IN FIRST LOOKS

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Scanners

Polaroid CS-500i Specializes In Small-Format

BY GREG PASTRICK

Flatbed scanners are ideal devices for handling large-format art, graphics, and text pages, but using a big scanner on a small piece of art can be like using a photocopier to reproduce a postage stamp.

Polaroid says that the majority of images that are scanned are smaller than 4 by 6 inches, and it created its CS-500i Digital Photo Scanner to handle just those tasks. This special desktop platform for the automatic feeding and scanning of small-format reflective photo media has found some practical high-volume uses that illustrate its rugged versatility.

The $4,495 scanner is designed to capture 24-bit color and 8-bit grayscale images from standard 35-mm and instant photographic prints at a maximum scan area of 4 by 6 inches. An included plastic carrier makes it possible to scan thin, fragile, or paper media under 1- by 2-inch dimensions, too.

The CS-500i's color capabilities are based on one-pass trilinear CCD array technology with a halogen light source that captures 24 bits of color information from 27-bit samples. Despite its high-resolution color talents, the scanner is a lean SCSI device that captures images at three resolutions and outputs to three standard file

• *Continues on page 42*

VOLUME: *The $4,495 CS-500i.*

Pen Software

Plan It, Crunch It, Doodle It: First General Pen Apps Ship

BY BRUCE BROWN

Pen computers and their applications have been slow to come to market, but three products are finally ready for early adopters: Slate Corp.'s Day-Timer Pen Scheduler, Ink Development Corp.'s InkWare NoteTaker, and PenMagic Software's Numero.

With these products, pen computing gains its first general applications: a PIM, a general drawing and writing tool, and a spreadsheet. InkWare NoteTaker and Numero are available for the PenPoint operating system only, while Slate's PIM will be available under both GO Corp.'s PenPoint and Microsoft Windows for Pen Computing. Here's a look at all three products.

■ SLATE CORP.

Day-Timer Pen Scheduler

For keeping track of a busy schedule on the road, Slate Corp.'s $195 Day-Timer Pen Scheduler, Version 1.0, is a smarter electronic pen-based version of the paper Day-Timer. Like all PIMs, though, this Windows for Pen Computing app requires consistent use to deliver full value.

Day-Timer Pen Scheduler includes the standard PIM features: calendar and appointment scheduler, address book, to-do list, and notepad. The calendar has day, week, month, and year views. The notepad has six page styles and a gallery view that displays a miniature look at nine pages at once. All the functions can be oriented in either portrait or landscape mode.

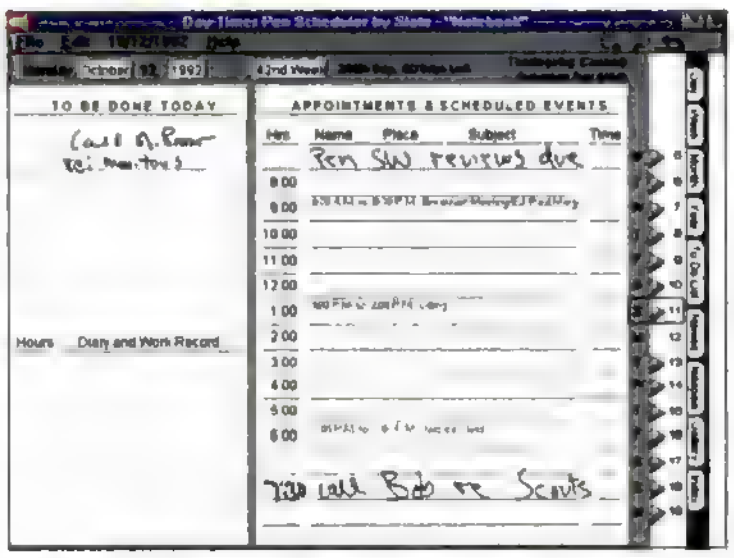
Though these tools are generally easy to use, some tasks require too many gestures. For example, entering a single appointment into the daily calendar uses five different screens, and takes as many as ten steps.

Day-Timer Pen Scheduler supports regular handwriting via the pen computer digitizer and stylus. Writing directly with the stylus, creating what is called "ink" on the screen, is more convenient than using character recognition for quick notes, scribbles, doodles, or diagrams, but you'd better be sure you can read your own handwriting.

Data transfer and indexed field entries call for "translated handwriting," Slate's term for handwriting recognition using the host pen-computer operating system's handwriting-recognition engine but Slate's own gestures. Day-Timer Pen Scheduler uses translated handwriting for appointment, name, and address information; the notepad index; and to-do list type and status fields. The pen gesture you'll use most is a lasso: a loop that indicates an area to be edited, deleted, copied, moved, or indexed.

The program's notepad resembles a pad of paper on which you can create free-form notes, charts, diagrams, outlines, lists, or any type of handwritten information. These notes can be indexed for later retrieval or sorting. You can also devise one or more project codes and use the codes to key the page to several different projects.

The scheduler supports automatic or repeated events for such entries as holidays, birthdays, regularly scheduled meetings, or periodic personal entries such as weekly sports practice. You can't create appointments for the first Tuesday of every month, however; selecting monthly intervals uses the same numeric calendar date. When you enter information in the scheduler, tiny text appears on the calendar to remind you to look for more details.



PEN PIM: *The Day-Timer Pen Scheduler's daily appointment view displays handwritten and translated tasks and appointments.*

Day-Timer Pen Scheduler's to-do list uses ink for list entries and handwriting translation for task type and status. You can sort tasks by type and/or status. Each task has a single line on the list view but can zoom to a full-page view for more details.

Individual sections of the Day-Timer Pen Scheduler can be printed for use in a paper-based personal organizer or for sharing with other people. You can print on optional preprinted Day-Timer forms or with simple headers and footers. Data can also be imported and exported in delimited ASCII and .DBF data formats.

This package takes 1MB of disk space. Though we reviewed the Windows for Pens version, a PenPoint version with the same capabilities and price was scheduled to ship this fall. If you're already using Windows for Pen Computing, the Day-Timer Pen Scheduler is a useful addition. But if you've made it this far without a personal organizer, buying into pen computing for this program is hard to justify.

• List price: *Day-Timer Pen Scheduler, Version 1.0, $195.* Requires: *386- or 486-based pen computer; 4MB RAM (8MB recommended); 1MB hard disk space; Microsoft Windows for Pen Computing 1.0 or later. Slate Corp., 15035 N. 73rd St., Scottsdale, AZ 85260; 602-443-7322; fax, 602-443-7325.*

Circle 425 on reader service card

■ INK DEVELOPMENT CORP.

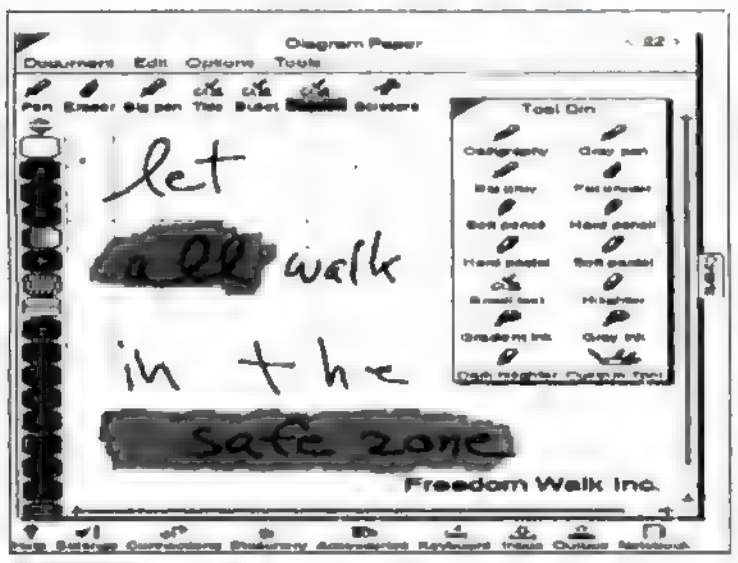
InkWare NoteTaker, Version 1.0.3

If ink as a data type is going to catch on, Ink Development's InkWare NoteTaker may be one of the reasons. NoteTaker lets you jot down or sketch ideas, and it functions essentially like an electronic legal pad with tools for freehand writing, drawing, and character and shape recognition. The $145 program, currently in Version 1.0.3, runs under PenPoint.

NoteTaker has a collection of predefined tools and page styles you can use to create freehand text and drawings. You can also create your own page designs and custom tools. A handwriting-recognition text tool and an automatic shape recognizer can enhance your pages, though they will slow you down.

You start NoteTaker by selecting a stationery design. The predesigned choices include page setups for notes alone, notes and doodles, sketches, diagrams, faxes, and presentations. Each layout has a different mix of page, margin editing, control, access, and comment options. In addition, a specified selection from the program's predefined tools is located on a horizontal icon bar.

The most generic NoteTaker stationery design is the note page. Note pages have six



INTUITIVE: *InkWare NoteTaker's predesigned pages contain a wide selection of tools and lines.*

preselected tools: two types of pens, an eraser, a highlighter, scissors for cutting and pasting, and text. Clicking on the text button activates character recognition for the body of the page; each page also contains icons to activate the shape recognizer and character recognition for the page margin. You can add to or replace the tools on the current page's toolbar by tapping on a Tools menu. Here you'll find choices such as bullets for charts, a calligraphy tool, a fat eraser, pastels (with definable ink), and hard and soft pencils.

To start taking notes with NoteTaker, select the pen tool and start writing in the page body. If you turn on character recognition in the margin and enter key words there, you can search for pages by those words later.

With the InkWare Search module, in the Edit menu of each NoteTaker document, you can search all NoteTaker pages by specified text or date. You may specify any year, month, and date, but you can't do fancy searches such as every other month over a period of three years.

Searching slows down during character recognition. Until recognizers get better or people learn to print more neatly, the advantages of character recognition will remain elusive. Current recognition engines make you spend too much time making entries correctly or, worse, correcting errors. NoteTaker uses the standard PenPoint character-recognition engine, so new developments for the operating system will help NoteTaker.

The NoteTaker Shape Expert is a pleasure to use, particularly for drawing floor plans, signs, or flow charts. There are shape icons for rectangles, ovals, straight lines, polyhedrons, and freehand shapes. To draw an oval, tap the oval icon, then sketch the oval where you want it. The Shape Expert translates that sketch into a regular shape.

You'll need about 450K of free hard disk space on your PenPoint pen computer for the NoteTaker application files. A quick installer module automatically installs NoteTaker from the distribution floppy disk onto your computer's hard disk, at the same time fitting it in with the PenPoint environment.

Using NoteTaker gets slower when you use handwriting recognition, as do all pen apps. Otherwise, this program is well integrated and a joy to use.

• List price: *NoteTaker, Version 1.0.3, $145.* Requires: *80386 pen computer, 4MB RAM, PenPoint 1.0a or higher, 450K hard. Ink Development Corp., 1300 El Camino Real, #201, San Mateo, CA 94402-9812; 415-573-6565; fax, 415-573-5167.*

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■ PENMAGIC SOFTWARE INC.

Numero

PenMagic Software's Numero won't replace the spreadsheet as the number cruncher of choice, but, as the only financial package available now, this $399 PenPoint program uses character recognition and easy page design to good advantage.

When you work with Numero, you can use predesigned stationery or create your own. There are four basic page types: Numero, Numero Formula, Numero Graph, and Numero Sketch. The regular Numero page has columns for entering numbers and labels. This is the page you'll use most. The Numero Formula page stores formulas and information about links between Numero pages. Numero Graph lets you chart portions of a Numero page using pie, bar, stacked bar, line, area, and HiLo charts. Numero Sketch is essentially a notepad.

Numero comes with more than 70 predesigned financial statements, financial forms and calculations, and other ready-to-use pages for shipping and inventory, travel and expense reports, time management, sales management, personnel management, presentations, and personal productivity.

Numero uses many standard PenPoint gestures for such functions as selecting areas and making and activating choices. Other gestures are unique to Numero: a single sideways stroke gets a subtotal on a worksheet, and a double stroke gets a grand total.

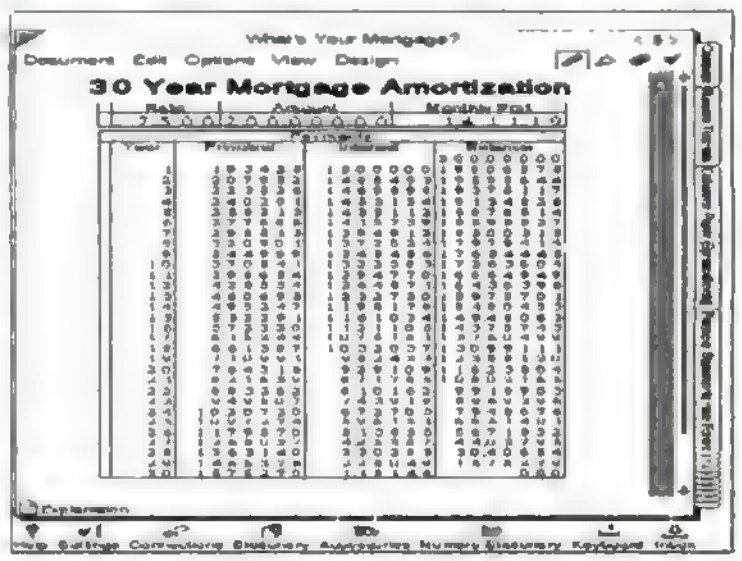
Numero uses PenPoint's own handwriting-recognition engine, which works adequately for creating or changing numbers, labels, and extra text anywhere on a Numero page. Handwriting recognition isn't suitable for medium- to large-scale data entry, however; it just takes too long. For extensive data or numeric entry you'll want a keyboard or numeric keypad.

Numero's functions are similar to those used in most spreadsheets. The program includes 26 financial, 9 mathematical, 5 statistical, 12 date-and-time, 10 logical, 3 lookup, and 9 cell-value–type testing functions. There are also 9 different summing functions.

Numero does not support macros, however. For this reason you can't create many automated worksheets. You can set up multiple sheets with dynamic linking, but you can't create an application that walks a user through a series of conditional steps based on new input.

Printing Numero documents includes a print-to-fit option and the ability to print embedded Numero Graph and Numero Sketch pages. Numero will import and export data files (though not charts, handwritten material, or unshared functions) to .XLS, .WK1, and comma- or tab-separated ASCII text formats, but these tasks are generally more cumbersome under PenPoint than under Windows for Pen Computing. There is limited font support for files imported from Excel. Macros do not import, and any functions not supported in Numero only import as values.

Numero requires a minimum of 800K of hard disk space for the application files and additional space for worksheets. The package's predesigned worksheets are convenient, but other than the use of gestures there's little you can do with Numero that you can't do with current versions of major spreadsheets.



FORMS GALORE: *This sample Numero page for calculating mortgages lets you calculate a 30-year amortization.*

• List price: *Numero, Version 1.0, $399.* Requires: *Pen computer, PenPoint 1.0, 800K hard disk space. PenMagic Software Inc., 310-260 West Esplanade, North Vancouver, B.C., Canada, V7M 3G7; 604-988-9982, 604-988-0035; fax, 604-988-0035.*

Circle 427 on reader service card

QuarkXPress

CONTINUED FROM PAGE 37

can create multiple H&J (hyphenation and justification) profiles for each document, then put them in a user-defined stylesheet to make short work of assembling complex yet consistent type specs.

Likewise, creating single or multiple drop caps is simple. Instead of fiddling with specific point sizes, you merely indicate how many lines of body copy the cap should drop.

On the most advanced level, Quark gives you total control over tracking and kerning. Not only can you define these values as part of a stylesheet, but you can easily access editable tracking and kerning tables. Compare this to the five predefined tracking settings offered by Quark's main competitor, Aldus PageMaker.

COMPETITIVE COMPARISON

Indeed, it's instructive to compare QuarkXPress to its two main competitors on the PC, Aldus PageMaker and Ventura Publisher. Like Ventura, Quark employs a frame-based approach to desktop publishing: You must first create a box to contain either text or pictures.

Frames give you plenty of formatting control. You can create a single text object that is formatted with multiple columns, a background tint, and a border. Compare this with PageMaker's pasteboard metaphor, where the same design would consist of at least four different objects.

Quark-XPress is like PageMaker in one important respect, however. It provides straightforward formatting commands, so even nonprofessional designers can easily spec type and position pictures.

FACT FILE

QuarkXPress for Windows, Version 3.1

Quark Inc., 1800 Grant St., Denver, CO 80203; 800-788-7835, 303-894-8888; fax, 303-894-3399

List price: $895.

Requires: 386- or 486-based system, 4MB RAM, 15MB hard disk space, Microsoft Windows 3.1.

In short: QuarkXPress for Windows is an art director's dream. The program provides unprecedented control over typography, precision layout tools, and the ability to directly generate four-color separations.

430 ON READER SERVICE CARD

While QuarkXPress may combine some of the best features from PageMaker and Ventura, it isn't a jack-of-all-trades. Complicated, book-length documents, for example, aren't its strong suit. Unlike both PageMaker and Ventura, QuarkXPress can't automatically generate a table of contents or an index. And while QuarkXPress can produce documents up to 2,000 pages long, it can't link individual files together as chapters in a book.

QuarkXPress does have some unique features. Its irregular polygon tool and user-defined gradient fills let you create simple—but elegant—drawings and diagrams. Though it's not meant to supplant a dedicated illustration program, QuarkXPress offers several sophisticated graphics functions, including the ability to group or lock objects, automatic alignment functions, and a step-and-repeat command.

FIRST LOOKS PLUS

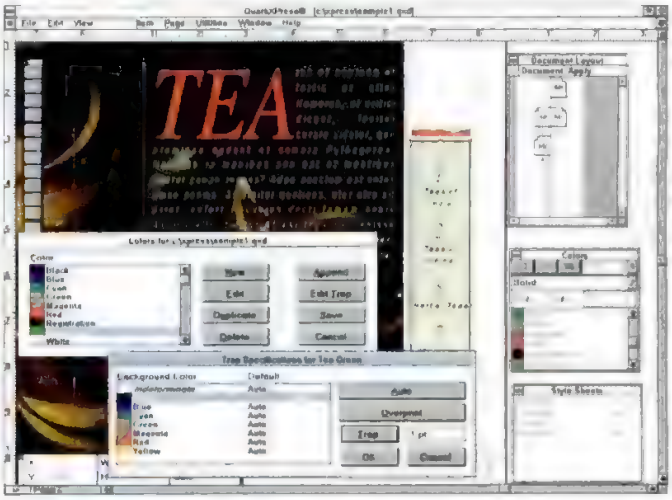
To download a working demo of QuarkXPress for Windows from PC MagNet, type GO ZNT:DEMOS from any CompuServe prompt. From November 23 through November 27, you can go online to discuss Quark with Luisa Simone and Quark Product Manager David Ambler. Type GO ZNT:EXEC.

FROM PC TO PRESS

You'll really appreciate QuarkXPress when the time comes to transfer a publication from your PC to a commercial printing press. It directly generates four-color separations from bitmapped images that support a CYMK format, such as .DCS or Version 6.0 of TIFF. And if you're working with named spot colors, it gives you the option of automatically converting RGB, HSB, Pantone, TruMatch, or Focoltone values into CYMK values when you generate final film.

The average business user will probably never access the program's trapping controls, but this professional-level feature addresses the inevitable registration problems that occur on press. Basically, it lets a designer determine how specific color pairs will overlap.

Quark's production-oriented tools are so flexible that they can even create artistic effects. For example, its image processing functions allow you to alter dramatically the appearance of imported pictures (in formats such as .BMP, CGM, .PLT, TIFF, and .WMF.). You can posterize imported gray-scale images, apply color tints to imported vector images, and develop unique halftone patterns.



QUALITY COLOR: *Expert trapping for high-quality separations.*

WISH LIST

QuarkXPress for Windows matches its Mac sibling feature for feature. And yet, we still have a wish list. The program should be able to wrap text on both the left and right side of a picture simultaneously. At the moment, it's an either/or choice.

And if QuarkXPress is to be a total success in the corporate environment, it must provide better support of PCL printers. Currently, if you send a file to a PCL printer, only your type will be printed at the correct resolution. Imported pictures will print at screen resolution, and in most cases, that means only 72 dpi. To produce high-quality printouts in your office, you must own a Windows-compatible PostScript printer.

The Mac version of QuarkXPress is well known for its Xtensions technology, which allows for third-party utilities such as database publishing and production tracking systems. Our wish list includes ports of these utilities from the Mac to the PC. In the meantime, QuarkXPress offers inter-operability with other Windows programs through OLE.

One disappointment, albeit a temporary one, is that QuarkXPress will not be immediately available through normal distribution channels such as retail outlets and mail-order. Until December 1, 1992, you can purchase QuarkXPress only through authorized dealers. But in the final analysis, the program's elegant artistic effects, professional-level production controls, and high degree of typographic precision make QuarkXPress worth the wait. □

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*Survey conducted by Peripheral Strategies, Inc., an independent research firm. Survey results taken from 9/92 study of 214 users of both Fastback and Central Point Backup. Survey results statistically accurate at a 95% confidence level with a sample error of ± 068

CIRCLE 079 ON READER SERVICE CARD

Polaroid Scanner

CONTINUED FROM PAGE 37

formats. It prints to any output devices attached to your PC (though it's not TWAIN compatible) as well as Polaroid's own digital photo printer (see the sidebar "Polaroid Helps On Output Side.")

WINDOWS-BASED

The CS-500i's Microsoft Windows-based scanning utility, SprintScan, comes with basic preview, cropping, and color processing capabilities, and it lets you sharpen and color-adjust images. You can scan at 125-, 250-, and 500-dot-per-inch resolutions and save the files to device-independent .BMP, TIFF, or Macintosh TIF formats.

As a post-scan option you can also shrink the image by adjusting its resolution, and by sizing and scaling it down to ten percent of its original capture dimensions.

The software controls for resolving, sizing, and framing images in prescan mode are easily accessed from a well-designed control panel. The software comes with a set of preset configuration files that define standard scan parameters for several media, including 35-mm Polaroid, Kodak, and Fuji prints (or any prints produced with C-41 processing). The configuration files can also set the scanner for instant prints that use Polaroid Polacolor, Spectra system, and 600 Plus formats, and they include standard settings for line art and gray-scale image sources.

You can use these settings as the basis for custom configuration files that match the media you scan the most. Fine-tuning the settings on the fly is no problem, with pull-down menus for sharpening, tone scale, and color adjustment. The SprintScan documentation gives an overview on the use of these advanced settings, and the color foldout on the back of the manual gives you a good visual reference of the overall effects of altering the tone scale (balance, contrast, and gamma correction), color (saturation and hue), and sharpness values (hard and soft).

The software also has a small set of image-editing effects to work with. You can crop and shrink your images, and roll them through 90 and 180 degree rotations. SprintScan's display zoom feature has nine levels of magnification, from 6.25 to 1,600 percent. You can use inches, millimeters, and pixels as units of measurement, but the program doesn't measure in picas, a standard in publishing.

To test the CS-500i, we used a variety of 35-mm and instant prints and found that the automatic feeder on the scanner handled everything we threw at it. The feeder did tend to skew the images scanned from heavily curled peel-apart instant films. Careful refeeding of the peel-apart prints or use of the carrier helped when this occurred.

HEAVY HARDWARE

As always with scanners, the speed with which a scan is processed is greatly influenced by the speed of your PC's processor, the presence of a high-performance graphics card, and the amount of available memory. Polaroid addresses some of the performance demands by giving the CS-500i a 2MB internal buffer, and by using the 8-bit Future Domain TMC-850M SCSI host adapter with a rated data-transfer rate of 1.9 MB/sec on a 4-inch wide 500-dpi scan. Even so, you need to look hard at your system to see if it's right for a scanner like this.

Polaroid requires use of a 16-MHz 386SX with a 32K color graphics adapter and recommends up to 16MB RAM. The software scans directly to memory and only goes to disk when it runs out of RAM or when you tell it to save to disk. For high-volume image processing, a 486 processor, 24-bit graphics adapter, and a minimum 300MB hard disk are recommended, though you can certainly get by with less. Just remember, a full-color 4- by 6-inch image scanned at 500-dpi will yield an 18MB file.

MANY USES

The CS-500i will find a home in many environments. Since many pieces of scientific and medical equipment output to Polaroid prints, the scanner can be used as a tool for advanced image analysis.

Citibank is currently using the CS-500i for producing VISA cards embedded with the cardholder's photo. Catalog publishers who use hundreds of small-format, low-resolution prints are potential users, too. The scanner can be used for quickly collecting lots of images for databases, and it could also find a niche as a photo-renovation tool.

If high-volume image collection from a variety of small-format sources is your primary electronic-image capturing task, the CS-500i is capable of handling it—in high-resolution 24-bit color. □

FACT FILE

Polaroid CS-500i Digital Photo Scanner

Polaroid Corp., 575 Technology Square, Cambridge, MA 02139; 800-225-1618, 617-577-2000; fax, 617-577-3888

List price: $4,495, $399 for Microsoft Windows Accessory Kit (includes standard SCSI card, cable, and SprintScan software).

Requires: 4MB RAM, 40MB hard disk space, Windows 3.0 or later, 8-bit AT slot, 15-bit Hi-Color graphics adapter (32,000 colors)

In short: With 24-bit color capabilities, standard resolutions and output to .BMP and TIFF formats, the CS-500i scans and processes hard-to-handle small-format photographic print sources with decent speed and efficient automatic feeds

(431) ON READER SERVICE CARD

Polaroid Helps on Output Side

Want to take Polaroids of your good-looking graphics screens? Attach the $1,995 CI-700 Digital PhotoPrinter to your PC and you'll have an easy way to print high-resolution 24-bit image captures as color proofs in under 40 seconds. The 11-pound, 4- by 13- by 13-inch CI-700 outputs 4- by 6-inch prints using Polaroid Spectra or Professional Type 990 instant film at 280- by 160-dpi resolution.

Not surprisingly, the output looks like any standard Polaroid print you've ever seen—a 3.6- by 2.9-inch image area with a thick white border. Unlike output from a color printer, you get a continuous-tone photograph with fine detail and fully saturated colors.

The benefits of this SCSI device in a production environment that demands fast turnaround are obvious. Not only do you get a more realistic proof and a better idea of what your final output will look like once it goes to film, but you have a ready-to-use print if your application doesn't require higher resolutions or finer color than the printer offers. For high-end image output needs, Polaroid has also shipped the $5,995 CI-5000 Color Film Recorder, which supports resolutions up to 4096 by 3600 for output to 18 different film types including Polaroid and 35-mm slide formats. The included ImagePrint software supports .CGM, .TGA, and TIFF imports and is compatible with standard presentation programs such as Freelance Plus, Harvard Graphics, 35mm Express, Applause II, and Mirage. The CI-5000 comes with an internal 640K buffer, measures 7 by 8 by 18 inches (HWD), and weighs 15 pounds. —*GP*

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CIRCLE 294 ON READER SERVICE CARD

Fonts

TrueType for DOS Brings Windows Fonts to DOS WordPerfect and Word

BY EDWARD MENDELSON

TrueType for DOS is the first program that lets DOS word processors use any of the thousands of TrueType scalable fonts that, until now, could only be found in Microsoft Windows. MicroLogic Software's $99.95 utility works with WordPerfect 5.*x* for DOS, Microsoft Word for DOS 5.*x*, and Microsoft Works for DOS, letting them use TrueType fonts with any HP-compatible laser printer or any standard dot-matrix or inkjet model.

Like earlier add-on font utilities for DOS word processors —FaceLift for WordPerfect, Fonts-on-the-Fly, PrimeType, and others—TrueType for DOS runs as a shell around your word processor. When you run the utility from the DOS prompt, it loads your word processor, and you use the same commands for editing and printing that you normally use.

When you print, TrueType for DOS intercepts the data that the word processor sends to the printer. If you have an HP LaserJet or compatible, the program converts your TrueType fonts into LaserJet soft fonts, which it sends to your printer along with your text. If you have a dot matrix printer, the program uses your TrueType fonts to create a graphical image of the page.

Windows works with TrueType in essentially the same way, and because MicroLogic licensed Microsoft's font-rasterizing module, you'll get the same font output from TrueType for DOS that you'll get from Windows.

36 TYPEFACES

The package includes 36 TrueType typefaces that you can also install in Windows. Most are crudely drawn knockoffs of standard designs, and you're better off with the fonts that ship with Windows itself or with any of the low-priced font packs offered by Monotype, Microsoft, or Bitstream. You can install any third-party TrueType font in TrueType for DOS by using the program's setup utility. Unlike PrimeType and other recent font add-ons, TrueType for DOS ignores the kerning data when it's installing fonts in WordPerfect.

The speed of TrueType for DOS depends on the speed of your system. A three-page WordPerfect document needed only 39 seconds to print to a LaserJet III from a 33-MHz 486 system—only 2 seconds slower than LaserTools' PrimeType, which uses PostScript-language Type 1 fonts. Because the processor in the printer is slower than the processor in the PC, the LaserJet III's internal typefaces needed 46 seconds to print out the file.

TrueType for DOS won't do anything for you if you work only in Microsoft Windows, but if you want to use the same TrueType fonts in both Windows and DOS, this is the one package that can grant your wish.

• List price: *TrueType for DOS, $99.95.* Requires: *440K RAM, 3MB hard disk space; DOS 2.0 or later. MicroLogic Software, 1351 Ocean Ave., Emeryville, CA 94608; 800-888-9078, 510-652-5464; fax 510 652-7079.*

Circle 429 on reader service card

Video

NDI's Warp 10: New S3 Chip Races Through Graphics

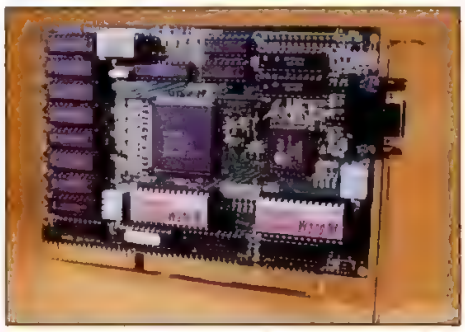
BY BEN MYERS

Video cards with graphical user interface acceleration are all the rage right now, and the National Design Inc. (NDI) Volante Warp 10 is one of the first such cards to use a second-generation GUI accelerator chip, the S3 86C801.

The 86C801 is a direct descendant of S3's first accelerator chip, the 86C911, and carries forward full compatibility with VGA and the earlier 911 chip. Popular wisdom has it that graphics cards need to feature pricey Video Random Access Memory (VRAM) to yield a combination of high resolution and fast performance, but the $299 Warp 10 provides snappy graphics with its 1MB of 45 nanosecond Dynamic Random Access Memory (DRAM).

Installation of the Warp 10 is a fairly easy plug-and-play matter. Three switches on the card, accessible from the back of the PC, control the monitor refresh rate at higher resolutions. A DOS utility allows you to override the switch settings, if needed.

PC Magazine Labs found that the Warp 10 displayed noninterlaced resolutions off-center at 800-by-600 and 1,024-by-768 on some monitors. The computer industry does not have standards in place for monitor synchronization, and many monitors do not have manual adjustments for centering your graphics on-screen. Consequently, the Volante Warp 10 card needs a utility that will center images on-screen at various resolutions and save the information to be used each time your PC is powered up.



ACCELERATE: *The NDI Volante Warp 10.*

The early production model of the Warp 10 evaluated by PC Labs didn't have a VESA pass-through connector for use with other graphics cards. The Warp 10 cards shipping by now, however, should have VESA connectors.

We tested the Warp 10 using PC Labs' new Graphics benchmark tests (see Lab Notes in this issue for a detailed explanation). At 800-by-600 resolution with 256 colors, the Warp 10 produced a Graphics Winmark 3.1 score of 5.7.

The NDI Windows drivers enable the Warp 10 to display 65,536 colors at 640-by-480 resolution, 256 colors at 800-by-600 and 1,024-by-768 resolutions, and 16 colors at 1,152-by-900 and 1,280-by-1,024 resolutions.

In addition to its Windows software, the Warp 10 has drivers for AutoCAD, GEM/Ventura Publisher, Lotus 1-2-3, Microsoft Word, WordPerfect, and several additional CAD packages.

The Warp 10 is a quick Windows performer at a fair price. It gives a taste of things to come in the increasingly volatile and competitive world of accelerated video.

• List price: *Volante Warp 10, $299. National Design Inc., 1515 Captial of Texas Hwy. South, 5th Floor, Austin, TX 78746; 800-253-8831, 512-329-5055; fax, 512-329-6326.*

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CIRCLE 148 ON READER SERVICE CARD

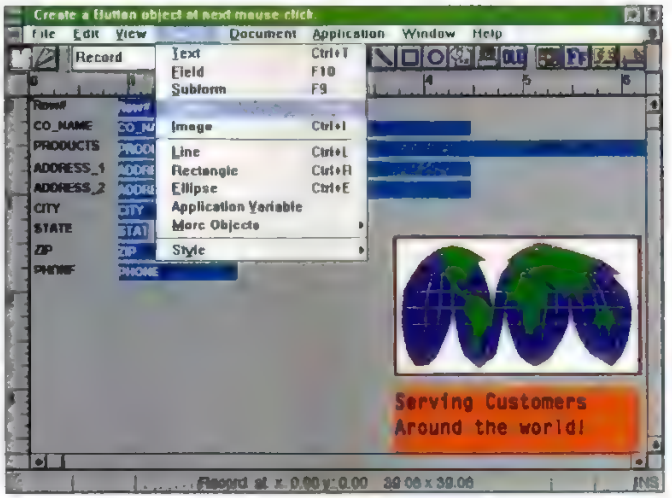
Databases

DataEase Moves into Windows—a Bit Too Quickly

BY JOE SALEMI

DataEase International has jumped on the Windows database bandwagon with the release of DataEase Express for Windows, Version 1.0, a $395 program that brings an object-oriented user-interface design as well as DDE and OLE capabilities to DataEase's forms-based relational database structure. (A full-scale version of DataEase for Windows is also expected.)

DataEase Express can also serve as a front end to other databases and SQL database servers through the DataEase SQL Connect drivers. However, there are still some rough edges to the product, and it appears to have been rushed to market.



NEW STRENGTH: *Relational power plus object orientation.*

DataEase Express uses the same relational file structure as DataEase 4.53 and is backward-compatible with it, storing data in tables that consist of columns and rows instead of fields and records. You can also import the data screens from the character-mode versions for modification and use in Windows. The reverse is not true, though, as tables and forms created with DataEase Express can't be accessed by other versions. DataEase Express also lacks the full programming power of the DataEase Query Language (DQL); it has only a subset of the DQL functions, which can be used for sorting, searching, and creating calculation fields.

Even so, DataEase Express's object orientation combines with the package's form-based orientation to make it easy to create forms and reports that can be combined into sophisticated applications. In fact, DataEase Express uses the term *application* to define the whole database, including the data itself and any forms, reports, or menus associated with it. Creating a new table is as simple as creating a new form and defining the columns and fields in the table.

DataEase Express has a number of relational features that are unusually powerful for a database in its price range. You can define validation rules for a field that ensure the data being entered is appropriate, and you can create dynamic links between different tables.

You can even establish referential integrity rules that automatically control what happens to the data in a child table when the related data in the parent table is changed or deleted.

DataEase Express has support for external databases and SQL database servers through its Prism client/server processor. Data-Ease Express uses a version of Prism that supports the Microsoft/Sybase ODBC (Open Database Connectivity) driver, and it includes built-in drivers for directly accessing dBASE III and IV data files.

An ODBC driver for Paradox databases didn't make the initial release but will be sent to registered users when it's ready. A driver to access the MS/Sybase SQL Server is available, and drivers for Oracle, OS/2 Database Manager, and other SQL servers are planned.

OBJECT ORIENTATION

Everything on a DataEase Express form or report is treated as an object, and each object can have its own definition and formatting controls (color, fonts, and the like). Every object can have an action associated with it, such as filling in a data value, calling a new form, or sorting the records in the database.

You can also include graphical images from a number of different sources, including .BMP, EPS, .GIF, .PCX, .TGA, and TIFF files. Using too many images in a form severely slows the program, however; redraws were noticeably slow on our 33-MHz 486 test system even with a graphics accelerator card.

NOT QUITE READY

Unfortunately, we ran into quite a few problems and bugs when testing DataEase Express. The program doesn't provide any method of importing data into a database. There's no support for any common import types, such as comma-delimited or fixed ASCII text files or .DIF files.

We also suffered numerous General Protection Faults (GPFs) while doing things as simple as adding objects to a form or querying the database. Windows would recover from the problem, but when we opened up the test application again, we would get cryptic error messages such as "Application objects are inconsistent" or "Relationships are inconsistent."

After a GPF, attempting to change and save the form that caused the GPF would also cause cryptic error messages that claimed the form could not be saved.

The other indication that the product may have been rushed is the inclusion of a 16-page README file that you absolutely must print out and keep handy, because it corrects many errors in the manuals. DataEase Express proves the maxim that you should take care when buying the first version of a software product. This program has many compelling features, but we can't recommend it until the problems we found are fixed.

FACT FILE

DataEase Express for Windows, Version 1.0

DataEase International, 7 Cambridge Dr., Trumbull, CT 06611; 800-243-5123, 203-374-8000; fax, 203-365-2317

List price: $395

Requires: 2MB RAM (4MB recommended), 3MB hard disk space, Microsoft Windows 3.0 or later

In short: DataEase Express brings an object-oriented application environment to DataEase International's relational database power at a reasonable price. But we found numerous problems and bugs in this version, and we recommend you wait for the next release

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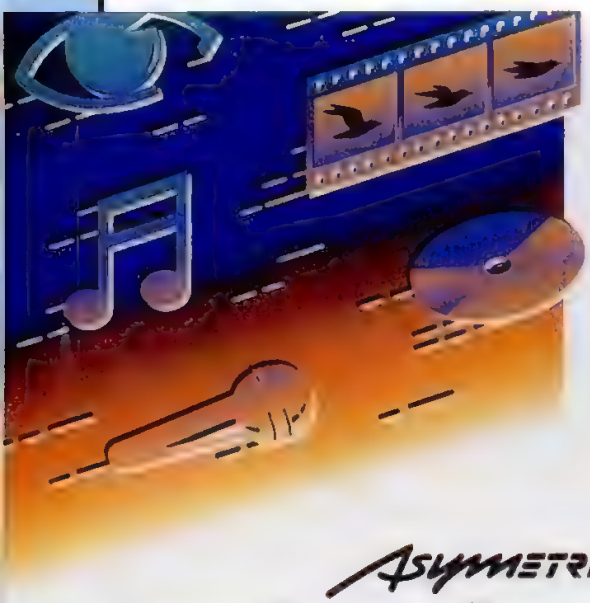

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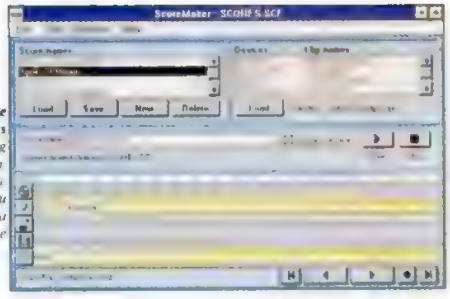

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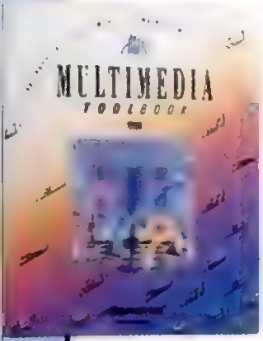

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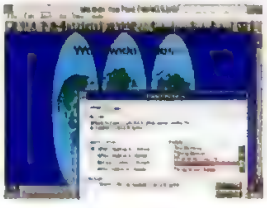

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Groupware

OnTime for Windows Gets Grown-Up Group Scheduling

BY GREGG KEIZER

Few of us work alone. We pair off, create in small groups, manage projects by department, or come to a company consensus. But with many personal information managers (PIMs), PC-based schedulers, and contact managers, each of us is an island, connected to no one.

Campbell Services' personal calendar, OnTime for Windows, has been available in a network version for over a year. This update, Version 1.2 (about $120 per station), corrects some substantial flaws and makes OnTime for Windows more suitable for sharing calendars.

OnTime Network, like its single-user ancestor, relies on various grids to show daily, weekly, and monthly views of appointments and meetings; displays to-do lists; and prints calendars you can tuck into a DayTimer or pocket. It's not a PIM, for it lacks such tools as an address database or auto-dialing. Instead, OnTime Network zeros in on scheduling.

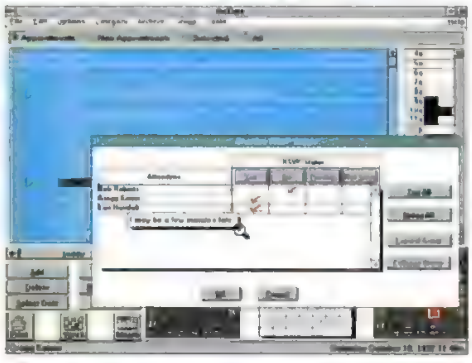
Through typical network security-style features, OnTime Network lets a supervisor designate users, allocate user names and passwords, and assign read and write privileges. Once setup is completed, you can view others' calendars—even those using the DOS version of OnTime—and create Group Add events, which place meetings or appointments on any selected user's calendar. Private messages and longer memos can also be attached to these events.

New to OnTime Network 1.2 is an RSVP function that sets a list of attendees and lets each respond with a single click of the mouse. Brief explanatory comments can also be attached. The meeting organizer can view the RSVP status grid, which details who can attend and who can't. One of the few problems we encountered was a tendency to garble comments attached to RSVPs.

More important, OnTime Network now supports workgroups, letting you designate both public and private subgroups of all OnTime users. This makes the program considerably easier to use in a large organization, for rather than manually selecting each recipient (as in the earlier version), you can simply pick the appropriate workgroup for a broadcast message or meeting.

Other additions include a reconciliation feature that coordinates calendars between network and standalone copies of the program, a boon to those running OnTime on a notebook. The program now also supports custom font selection during printing.

OnTime Network 1.2 improves on an already capable Windows scheduler and moves it out of the small-group ghetto it had inhabited. OnTime is now a capable workgroup calendar.



RSVP: *Find out who can make your meeting.*

• List price: *OnTime for Windows, Network Version 1.2, $357 (3 users).* Requires: *2MB RAM, 2MB hard disk space, Microsoft Windows 3.0 or later. Campbell Services Inc.; 21700 Northwestern Hwy., #1070, Southfield, MI 48075; 800-345-6747, 313-559-5955; fax, 313-559-1034.*

Circle 415 on reader service card

Spreadsheets

Graft Presentation Tools Onto 1-2-3 with Success

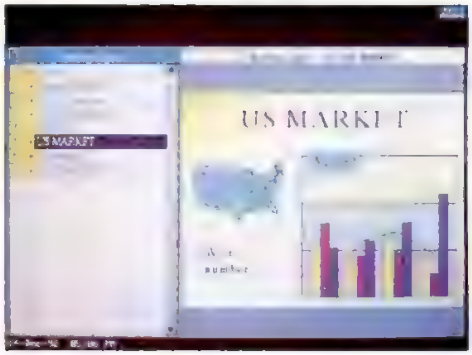
BY CRAIG STINSON

Borland scored big against Lotus when it built a slide-show facility into both the DOS and Windows versions of its Quattro Pro spreadsheet, and Microsoft followed suit with Excel. But until the arrival of Intex Solutions' $159.95 Success, the Lotus 1-2-3 user looking to create a presentation from within the program was out of luck.

Success leverages what many 1-2-3 users already have and know: the WYSIWYG publishing add-in. It uses WYSIWYG's graphics engine and fonts, as well as some of WYSIWYG's character-level attribute commands. You must have WYSIWYG (or PC Publishing's Impress) installed to use Success.

The program divides your screen into size-adjustable outline and slide-preview panes. In the outliner, you enter text or declare links to worksheet data; in the preview pane, you can adjust the size and position of text and graphics elements, using either keyboard or mouse. The slash key invokes a 1-2-3–style menu; the F3 (Names) key brings up dialog boxes for adjusting bullet styles, text colors, and a myriad other details.

Success can turn worksheet data into attractively formatted tables and charts that remain current as underlying .WK1 files change. The program also provides an assortment of presentation tools that will be more than ample for most users, including bullets in many styles, rudimentary drawing tools, org charts in various layouts, gradient fills, visual transitions (no sound effects), speakers' notes, and even branching hot buttons.



SLIDES: *Success has basic slide-show tools.*

At show time, you can bring along your supporting .WK1 and .FMT files or bundle them all into a runtime file. Intex provides a runtime viewer, which you may distribute freely, and the viewer lets you turn your show into an unstoppable demo.

Font support is one of Success's weaknesses. You're limited to whatever fonts you've installed via WYSIWYG. You can add to your WYSIWYG set via PC Publishing's Fontasia utility, or use a font converter to turn other formats into WYSIWYG's own format.

Success doesn't try to be a full-featured presentation package, but for the 1-2-3 maven who needs attractive slides in a hurry, it offers a lot of functionality very close at hand.

• List price: *Success, $159.95.* Requires: *640K RAM; Lotus 1-2-3, Release 2.x; WYSIWYG or Impress. Intex Solutions, 161 Highland Circle, Needham, MA 02194; 617- 449-6222; fax, 617-444-2318.*

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NOMAD 325SXL ■ **$1795**
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Upgrades

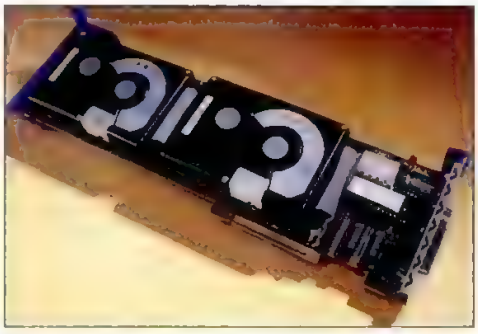
Rev Up Your 286 with ALL's 486SX/25 Upgrade

BY WINN L. ROSCH

If you're tired of watching your 286-based PC get more and more obsolete with each passing month, your salvation may be the ALL SX 486-25 from ALL Computers. This simple but pricey ($599) plug-in microprocessor upgrade will turn your 286 PC into a 486 operating at 25 MHz.

You get all the benefits of the latest microprocessors—memory management, 32-bit instructions, virtual 8086 mode—so you can run 386-specific software (such as Windows 3.1 and OS/2). The basic package even includes ALL Charge 386 memory management software (which retails for $99 by itself). While most 386SX upgrades for 286 machines deliver little speed improvement, the ALL SX 486-25 doubled the performance of a 10-MHz 286 on our tests without slowing disk or video operations.

The 1.5- by 2.75-inch board is based on the Cyrix 486SLC microprocessor, a chip that understands the Intel 486 instruction set but offers only a 16-bit interface and an internal 1K two-way set-associative write-through cache. Although the 486SLC lacks an internal coprocessor, you can add a Cyrix or Intel 387SX to the ALL SX 486-25.



NEW LIFE: *The ALL SX is an easy upgrade.*

In PCs using 286 chips in plastic leadless packages (as most do), installation of the ALL SX 486-25 requires only popping out your old chip—using the extractor supplied by ALL—and pressing the board in its place. PCs using pin grid array-packaged 286 chips (such as IBM ATs and PS/2s) will require a PGA adapter from ALL, a $10 option. PCs with leadless chip carriers require a $70 adapter cable. For 386-based PCs, ALL also offers its DX 486-33, a Cyrix 486DLC upgrade priced at $499.

Although your PC will boot from the ALL SX 486-25 right after you plug it in, recognizing the internal cache of the 486SLC requires running a software driver. ALL provides drivers for both DOS and OS/2 as well as an automatic installation program.

The ALL SX 486-25 caches all the RAM already in your PC and lets you add more ordinary extended or expanded memory exactly as you would normally increase your PC's capacity. You can further improve performance by adding an ALL Card Mark IV, which provides direct-access zero-wait-state performance with 70-ns SIMMs.

Although the ALL SX 486-25 won't make your 286 PC as quick as a real 486, it's an easy-to-install and effective upgrade.

• List price: *ALL SX 486-25, $599; PGA adapter, $10; LCC adapter, $70. ALL Computers Inc., 1220 Yonge St., 2nd Fl., Toronto, Ontario, Canada M4T 1W1; 800-627-4825, 416-960-0111; fax, 416-960-5426.*

Circle 424 on reader service card

Alternate Input

$895 TouchMate Turns Any Monitor into a Touch Screen

BY BRUCE BROWN

If you want to control an application by touching the screen but don't want to invest in an expensive touch-screen monitor, Visage Inc.'s $895 TouchMate is an alternative that is easy to install and use. TouchMate can be used with both DOS and Windows applications and supports any kind of stylus, including your finger, as a pointing device.

The TouchMate device is a 10-pound platform measuring 1.7 by 13.5 by 14.2 inches (HWD). All you do is place any regular computer monitor right on top of it. The only restrictions on the monitor you use are diagonal screen size (12 inches to 19 inches) and weight, which can be no more than 90 pounds.

The TouchMate works by sensing three-dimensional monitor movement when you touch the screen. Eight capacitive sensors inside the platform are checked 50 times a second to detect movement from a calibrated baseline position. The system's 40-point-per-inch screen resolution makes it less precise than a typical 200-dot-per-inch mouse for detail work such as drawing, but it's fine for choosing commands from a menu or for activating actions via icons or program buttons.

TOUCHMATE: *Sits under your monitor.*

The TouchMate connects to your computer via an included serial cable. During software installation, the device is calibrated for your monitor, and the appropriate drivers are installed. The Windows driver installation builds a Windows Program group with icons to load and unload the TouchMate driver, to calibrate the screen, and to bring up a TouchMate configuration control panel. TouchMate can coexist with a mouse as long as you have the necessary ports to support both the mouse and the TouchMate cable.

You have to use a bit of care during installation to center the monitor on the TouchMate platform to be sure cables are out of the way and to ensure that a rear-mounted monitor support stand makes solid contact with the back of the monitor. You'll get more precise recognition if you place the device on a sturdy table or desk.

But, like magic, it works. A test on a very shaky table, using a standard 14-inch VGA monitor with the tilt/swivel stand attached, produced acceptable results, including running applications in Windows. Editing a word processing document by using a pencil directly on the screen also worked.

TouchMate is a great way to set up systems for use in kiosks, for environments where a mouse or even a keyboard would be hard to use, or for applications that can be run using programmed buttons.

• List price: *TouchMate, $895.* Requires: *Serial port. Visage Inc., 1881 Worcester Rd., Framingham, MA 01701; 508-620-7100; fax, 508-620-0273.*

Circle 423 on reader service card

Fax Software

$119 UltraFax Combines Basic and Advanced Tools

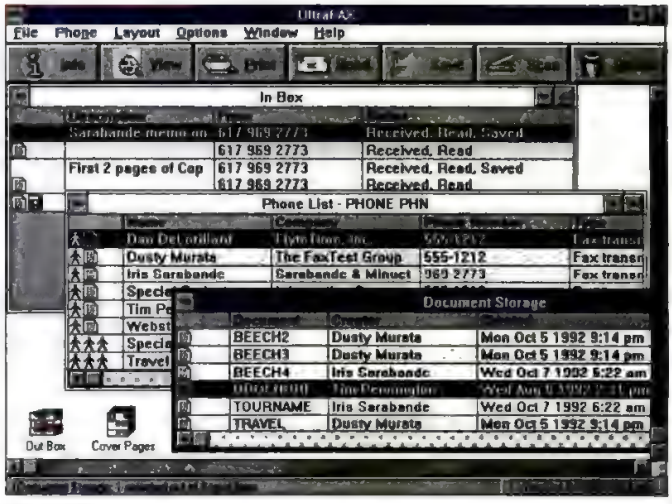
BY DAVID DEJEAN

If you use a fax board, UltraFax isn't the software you started with, but it may be the software you stay with. If you run Microsoft Windows, UltraFax's price and features make it an irresistible upgrade. For $119 list, you get a well-executed Windows package that provides an extensive set of tools for faxing.

UltraFax is an interesting blend of basic functions and advanced capabilities such as image editing, character recognition, and file transfer.

At its most basic level, UltraFax provides good support for managing fax messages. The graphic design of its interface isn't exactly drop-dead stylish, but it is flexible: If you want to sort your incoming faxes according to sender and your saved faxes by date, UltraFax can handle it. It's also easy to forward faxes.

The character recognition (from Ocron) is fast and accurate, but basic. Its speed is a good thing, because recognition is not done in the background; you look at a dialog box until it's done. Typically that's only a couple of minutes per page, and the results are very good. In tests, turning a three-page fax into an ASCII text file produced text at the rate of 130 words a minute. This is about twice the speed of a skilled typist, and it compares very favorably with other, more expensive products in this category.



FAX TRACK: *UltraFax keeps track of your faxing.*

UltraFax supports most popular scanners, which means you can use it to send paper-based faxes as well as electronic documents. It also means that you can scan material—artwork, logos, or text—and use the program's image-editing tools to edit it into new documents and existing faxes.

UltraFax has obviously been engineered to work with as many kinds of fax boards as possible, and, more importantly, to work as well as possible. It will bring many new features to users of low-end fax cards from makers like Frecom. And it supports the functionality of the most advanced cards, such as the Intel SatisFAXtion board. Not only will it handle CAS-spec file transfers, it even reads in existing Intel-format phonebooks automatically.

• List price: *UltraFax, Version 1.0, $119.* Requires: *2MB RAM (OCR requires 2MB free XMS); 4MB hard disk space; Class 1, Class 2 or CAS-compatible fax board; Microsoft Windows 3.0 or later. ZSoft, 450 Franklin Rd., #100, Marietta, GA 30067; 800-444-4780, 404-428-0008; fax, 404-427-1150.*

Circle 420 on reader service card

Windows Utilities

Trailblazer: A Strange Feel For File Management

BY BARRY SIMON

How do you get market share for your file manager in the overcrowded Windows utilities category? Twisted Pine Software's $77.77 Trailblazer tries by presenting a totally different look and feel. You may like the look, but the feel may be uncomfortable.

You know this program will be different when a map pops up during installation and asks you to pinpoint your location. Later, when you run the program, a corner of the program window shows a forest scene with the sun or moon at the appropriate place in the sky for the time of day at your location. That's certainly a software first.

The main window has static "slates" sunk inside a lattice that looks like polished marble. When icons are used, they are big and bold. Rather than displaying an hourglass during lengthy operations, the program pops up a window and fills in a photograph chosen at random from its collection on disk.

While the look is intriguing, the feel is disconcerting because the program does many things in nonstandard ways. For example, in its file lists, Shift-click extends file selections the way Ctrl-click does in most other Windows applications.

SUNRISE: *Trailblazer looks unique.*

The program has a main panel that defaults to a linked tree and file list. Above this is a strip (called the path slate) that shows the directory path to the current files, with icons representing the drive and each subdirectory leading from the root to the current files.

To copy, you select files, and the path slate shows "bundle" as its final icon. You drag that bundle icon to the forest scene, which it temporarily covers. Then you maneuver to the destination directory and drag the bundle to the target directory in the path slate. Once you get the hang of it, these operations are fast, but you do have to learn and remember an eclectic approach.

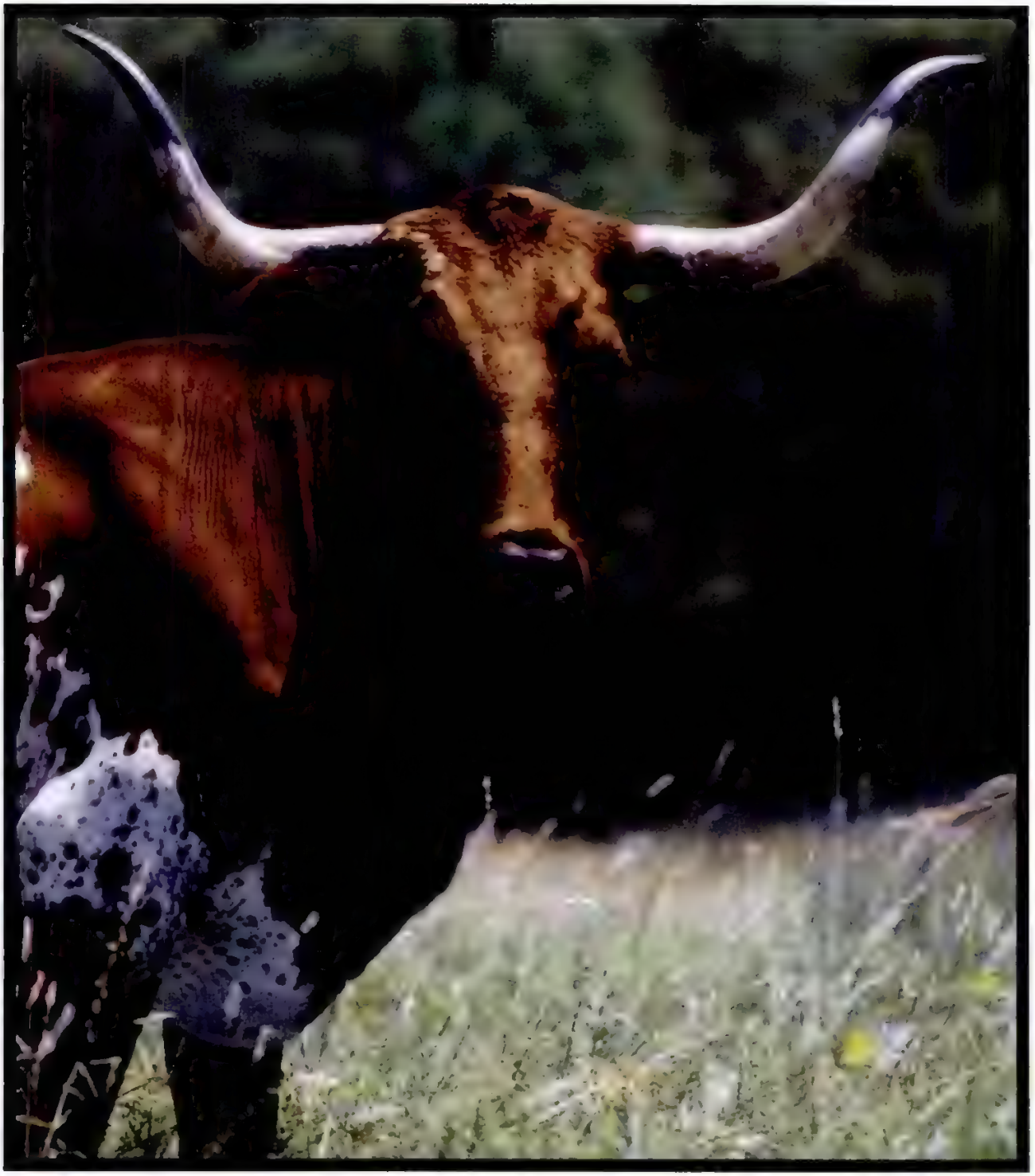
Trailblazer does little more than the file-management and program-launching basics. You can only view directories on one drive at a time, and there are no file viewers, nor is there any ZIP file control. Buy Trailblazer for its looks, not for its high-end file-management tools.

• List price: *Trailblazer, Version 1.1, $77.77.* Requires: *4MB RAM, 2.5MB hard disk space, Microsoft Windows 3.0 or later. Twisted Pine Software, 9320 Hillside Trail South, Cottage Grove, MN 55016; 800-775-7463, 612-458-5833; fax, 800-775-8772.*

Circle 419 on reader service card

DO SOMETHING™

NEW BREED



DO SOMETHING

486SX/33—$1999

This Hyundai 486SX-33 can out-muscle those barnyard bovines of cow country. But you be the judge.

Our 32 Megapixel "Longhorn" Local Bus?... or a 1 Megapixel moo cow? Our "faster-than-a-blink" *Windows accelerator video processing* tied to the speed of your 486 CPU?... or an old-fashioned bottleneck? Our *1MB VRAM controller* producing 1024 x 768 ultra-high, non-interlaced resolution?... or their tired cow VGA? Clearly, the prize goes to the Hyundai New Breed.

Compare our *standard 128KB of zero-wait state cache* with non-cached cows. And don't forget, the Hyundai 433S flexes its processing muscle up to 256KB of cache expansion. This system runs at the head of the stampede!

Hyundai 433S

- 33MHz 486SX w/ 8KB integrated cache
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- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Upgradable to 486DX power via Intel Overdrive™ socket
- 4MB system memory expandable to 64MB on system board
- 120MB 19ms IDE HDD, 32KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs, (2.88MB-ready FDD interface)
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- 2S/1P, integrated PS/2 mouse port
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- Built-in virus protection, front keylock, 2 level password
- MS DOS 5.0 and MS Windows 3.1

And we don't just drive the Hyundai stampede, we overdrive it! Double your speed by simply snapping in the *Intel Overdrive™ Processor*. And our advanced "warpspeed" L2 cache and "Longhorn" Local Bus graphics engine give your upgraded system the 32-bit video and fast SRAM you'll need for your higher-speed 486 CPU.

Hyundai 433S

Want to talk add-ins? We test our 486 systems with literally hundreds of industry-standard cards and software applications. We test software compatibility on Novell (we're fully certified and a Novell Alliance Program member), Banyan Vines, OS/2 2.0, LAN Manager, and SCO UNIX, plus hundreds of programs running under Windows and MS DOS.

Trouble on the data frontier? Relax. The Hyundai 433S is loaded. A beefy 120MB superfast hard disk, two floppy drives, five external/two internal drive bays, and seven expansion slots mean you won't go hungry for performance. And dressed up with our 14" flicker-free, non-interlaced, color display, the New Breed 433S is the new king of PC country.

intel inside

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Inverted Back

1. Follow instructions on the other side

Back

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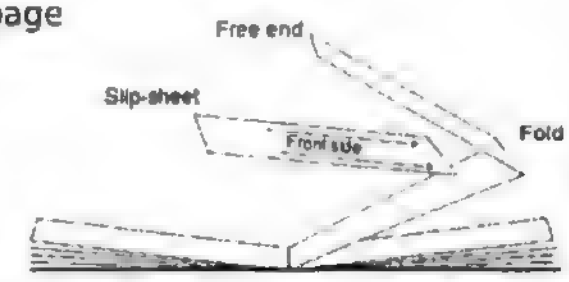
Folded edge of the page

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

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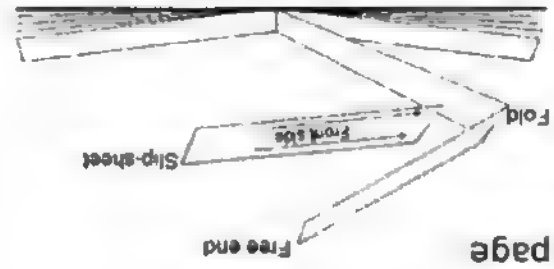
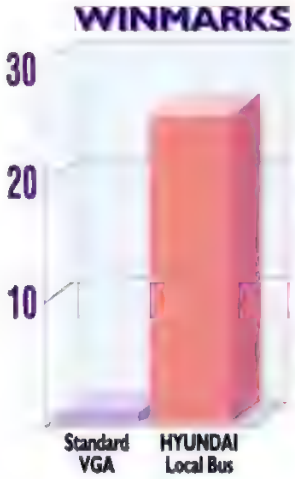


DO SOMETHING

486 STAMPEDE

That thunder you hear on the PC prairie is the New Breed Hyundai 486 stampede. The hardest-charging, price-lean, MIPS-mean herd of computers you'll ever see. We're bringing everything from powerful 66MHz 486DX2 machines to Overdrive-Upgradable 486SX-25 computers. And with our 50MHz 486DX2 desktop PC and 486DX-33 blasters, you can handle today's demanding applications.



Do something "Longhorn" Local Bus.

That flash you see on the graphics horizon is the image of our Windows processing power triggering the Hyundai 486 stampede.

Your 486 processor was meant to run today's applications. So why rein in all that power? That out-to-pasture, 16-bit VGA card can only deliver 2 Megapixels at best. That's already dated technology. Let her rip with 32-no-blink-bits of "Longhorn" *Local Bus video acceleration.* And with up to 32 Megapixels *standard*, believe it, you'll see an incredible difference in Windows performance.

Do something thunderbolt.

Lightning-fast *"warpspeed" L2 caching* is another max-performance feature that's designed into every Hyundai 486. Thunderbolt write-back operations blast your DOS, Windows, or OS/2 data into a box canyon of ultra-fast SRAM. Start out with 128KB standard (more than the cow computers), then expand to 256KB to handle today's big applications. Cache hit for cache hit, the Hyundai 486 Family, with 128KB standard caching, delivers twice the MIPS of non-cached cows.

Do something upgradable.

The Hyundai 486 New Breed Family is designed in Silicon Valley, U.S.A., to out-perform the herd.

All of our systems are *CPU-upgradable* through a single chip via a *ZIF or Overdrive socket*, so the New Breed lets you double your speed. We won't let tomorrow's 32-bit operating systems blast a hole in your productivity. Just upgrade your Hyundai 486 to any higher-speed Intel 486 CPU in the future.

AND PUT THE OLD BREED OUT TO PASTURE.

Every cow has its day. But it's time to put that milker out to pasture and make way for the Hyundai 486 stampede. It's time to Do Something New Breed®.

Say goodbye to "cow-shed" engineering and mother-board-of-the-month manufacturing. At Hyundai, we're doing *U.S.-based, end-to-end, value engineering and manufacturing.* That means benchmark-blasting power from the new Hyundai family of 486 Systems.

And with up to *32 Winmarks* of Windows processing power, Hyundai's bulletproof, 32-bit 486 Systems are designed and engineered for your high-throughput applications. For instance, *Local Bus Graphics are standard* on every system, from our entry-level computers up through our top-of-the-line desktops. You'll tear through Windows with our razor-sharp, 32-bit processing. Plus, up to 32 Megapixels of mind-bending *GUI acceleration is standard* with every New Breed 486 from Hyundai. And here's more New Breed value engineering. Our expandable,"warpspeed" *L2 cache architecture is standard* on every Hyundai 486 system.

Made-in-America engineering excellence is coming through the gates with the backing of a global high-tech leader. Now Do Something New Breed. And turn the page....

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CIRCLE 031 ON READER SERVICE CARD

Fonts

Fontographer: Expert Font Editor Comes to the PC

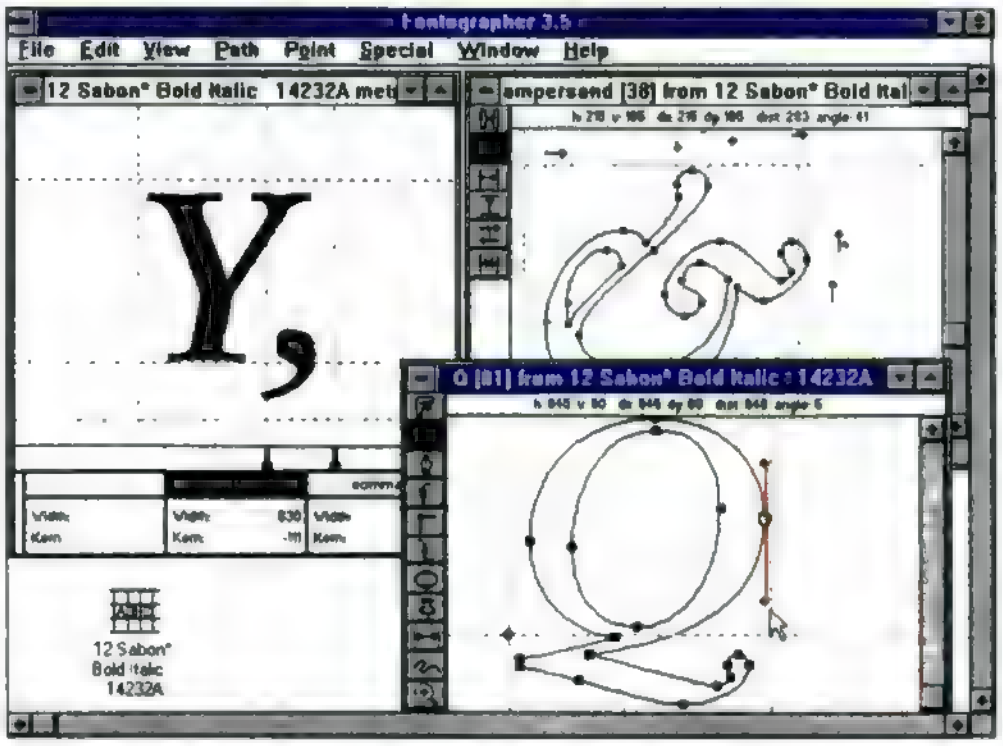
BY EDWARD MENDELSON

Until Altsys Corp. released its $495 Fontographer for Windows, Version 3.5, you needed a Macintosh or Unix machine if you wanted professional-level software for creating and editing scalable fonts.

Expertly ported from the long-established Macintosh version, Fontographer is a mature tool that all PC-based graphics professionals will want. Many amateur and business users will find it invaluable for its ability to add logos or other symbols to existing fonts, or to modify and customize individual characters and complete typefaces.

Unlike earlier font-editing software like Ares Microdevelopment's FontMonger and ZSoft Corp.'s Publisher's Type Foundry, Fontographer lets you control kerning, hinting, and other advanced typographic features. The program imports and exports Type 1 (PostScript) and TrueType outlines; it can also generate bitmap screen fonts for Windows, although on-the-fly font scaling with Adobe Type Manager and TrueType makes these bitmaps unnecessary.

Fontographer can import and autotrace scanned images as the basis for the characters in a font, or it lets you draw a font directly with a mouse or drawing tablet. It responds to a pressure-sensitive drawing tablet by altering the width of a line according to the pressure you apply, and you can customize the way it handles input from the tablet.



TYPE DESIGN: *Fontographer includes several editing screens.*

When you open an existing font, you see a display of all its characters. Then you select one or more characters for modification in an editing window, or simply select a group of characters for one-shot modifications of such features as height and weight through fill-in menus.

Fontographer's editing screens give you five different ways to view characters. The main screen lets you work on four different "layers." When you choose the foreground layer you can draw or modify the lines, arcs, and Bezier curves that make up the character itself. A background layer lets you import or draw images and lines to help you in the foreground layer. A guidelines layer lets you modify the x-height and other standard features.

The most advanced view displays the hinting layer, in which you can customize the hints that regularize low-resolution output. You can create individual hints in separate characters for fonts that you export in Type 1 format, or you can use autohinting for fonts that you output in either Type 1 or TrueType. All but the most arcane techniques in the Type 1 specification are supported. Unlike FontMonger, which also offers autohinting, Fontographer lets you control global features of the hinting it applies by itself.

The views in all these editing layers can be zoomed in or out, and include intuitive toolbars that give you quick access to the control points of curves and to various drawing tools. A separate editing screen for font metrics lets you modify the width and position of individual characters and kern pairs.

Keyboard shortcuts let you control font metrics in large or small increments. If you want to add kerning to a typeface that doesn't come with kern pairs, you can import and modify kern pairs from a similar typeface.

Fontographer supports Windows' Multiple Document Interface, so you can keep as many fonts and characters on-screen as memory permits. Any view can be reduced to an icon when you don't need it. By working with multiple characters, you can create composite characters like fractions in a few steps.

GOOD FOR CONVERSIONS

Like FontMonger, Fontographer can be used as a conversion program between Type 1 and TrueType formats. Just import a font in one format and export it to another. Fontographer's conversions are more accurate than FontMonger's, and the program doesn't alter font weight the way FontMonger often does, but they're still not good enough for serious use at low resolution.

If you expect to modify your fonts often, make sure to save them in Fontographer's own format or in Type 1 format, even if you only plan to use them in TrueType format. When you import a TrueType font into Fontographer it has to add control points to the original curves, and this adds to the complexity of working with the outlines.

Unlike the Macintosh version, which works with both Mac and PC versions of Type 1 and TrueType fonts, the Windows version exports PC fonts only.

If you want to use your fonts on the Macintosh, you can get a copy of the Macintosh version of Fontographer and use it to regenerate fonts created with Fontographer for Windows. Alternately, buy a copy of FontMonger for Windows and use the Macintosh font transfer utility that comes in the package.

Unless they work in large foundries with access to workstations, most professional and amateur type designers use Fontographer on the Macintosh. PC users, after years of waiting, now also have the most powerful and well-designed font-editing tool available on a desktop—and probably the easiest font-editing program available anywhere. □

FACT FILE

Fontographer for Windows, Version 3.5

Altsys Corp., 269 W. Renner Rd., Richardson, TX 75080; 800-477-2131, 214-680-2060; fax, 214-680-0537

List price: $495.
Requires: 4MB RAM, 2MB hard disk space, Microsoft Windows 3.1.
In short: The best font creation and editing package on the Mac finally arrives in Windows. Graphics professionals will love its advanced controls

416 ON READER SERVICE CARD

■ Communications

Home Office: One Phone Line Is All You Need

BY CAROL ELLISON

If you need a receptionist but don't have the salary in your budget, Prometheus Products' Home Office may fit the job description. A leader in Macintosh voice-fax messaging systems, Prometheus' first PC-based products are Home Office, which we tested, and Ultima Home Office, its 14,400-bps offering.

Despite its name, this $299 integrated voice/fax/data system can handle up to 999 message mailboxes, making it useful as a central reception tool in offices.

Home Office is a software and hardware combination that features Prometheus' own MaxFax voice/data/fax software for Microsoft Windows and an 8-bit internal 2,400-bps V.bis modem featuring MAP 5 data compression and error correction for up to 9,600-bps fax/voice/data. The combination effectively turns your PC into a console that serves as a fax and answering machine, as well as a data modem. The package even offers high-end options you'd expect to find in the more expensive voice-mail systems and fax machines.

VOICE-MAIL RETRIEVAL

Each individual voice mailbox can have a separate personal extension code and recorded greeting. To retrieve your voice-mail or record new greetings remotely, just phone in and enter some codes. Messages are played back through your telephone. There's even a call-forwarding feature that can phone a remote number, such as a pager, and alert you to waiting messages. Home Office also supports the Distinct Ring service offered by some telephone companies, which provides up to four separate phone numbers with distinctive rings to the same telephone line.

Home Office allows up to 999 fax phone books. To assemble individual distribution lists for batch fax transmissions, simply click on names in a phone book and drag them to a "To Send" window. The phone books can contain a person's voice phone number and address in addition to name and fax number. Since MaxFax installs as an output driver, you don't need to leave your application to send a fax. You simply load the driver in your printer setup, click on Print, and MaxFax will convert and send any ASCII, .IMP, .PCX, or TIFF file in G3 fax format.

EASY SETUP, NO JOKE

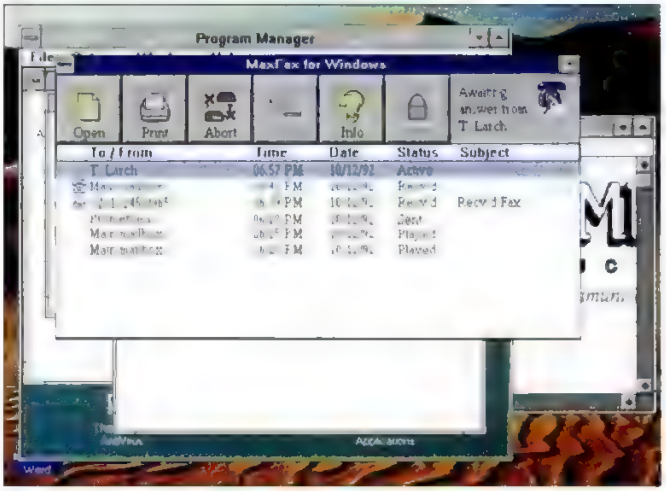
Thanks to Prometheus' excellent documentation, setup is one of the easiest and most straightforward we've seen for an internal modem. The board ships with settings for installation on COM2, but step-by-step instructions clearly illustrate how to reset dip switches, interrupts, and I/O addresses for installation on other COM ports.

Documentation for MaxFax wisely cross-references the modem and software manuals to reduce confusion when configuring the software. Software installation is automatic, but you can skip certain steps. Installation modifies your AUTOEXEC.BAT file to automatically load the TSR that MaxFax needs in order to enable communications when you start your PC.

You probably won't want to leave the TSR loaded, since it consumes a whopping 100K. If you have a large enough memory block available, you can load it high, but there's a far better strategy: store all the documents you plan to fax, then load the TSR, and schedule a batch fax at the end of the day. The TSR holds 1,000 messages in memory. Prometheus plans to reduce the size of the TSR in future versions.

MESSAGE LOG

All incoming and outgoing communications are logged in the MaxFax Control window. The software identifies new voice messages with a tiny icon of a telephone, and unread faxes with a tiny icon of reading glasses. It also displays the recipient of a voice message and its status: Received or Played if it's a voice message, and Sent, InQue, or Received if it's a fax message.



PHONE HOME: *Home Office displays the status of fax messages that you send and receive.*

The control window offers other icons for managing communications: play a message; put a fax on hold, print or resend; and delete a message or fax from the queue. A separate module has a viewer where you can read incoming faxes or preview those you plan to send.

Additional options let you limit the amount of hard disk space used for messages and the amount of time voice callers can record messages. Four faxes, three voice messages, and a greeting filled just under 1MB on our test system.

Call screening, which sends the caller's voice through the modem speaker as a message is being left, can be enabled, and you can change the sampling rate of sound input to affect the quality of your voice messages.

If you often find yourself away from the office and need an automatic, centralized way of handling fax, voice, and data messages, Home Office is one of the most comprehensive, easy-to-use solutions on the market today. □

FACT FILE

Home Office, Version 1.0

Prometheus Products Inc., 9524 SW Tualatin Sherwood Rd., Tualatin, OR 97062; 800-477-3473, 503-692-9600; fax, 503-691-5197

List price: $299 Ultima Home Office with support for 14,400-bps data communications is $539

Requires: 2MB RAM, 2MB hard disk space, Microsoft Windows 3.0 or higher, DOS 3.3 or higher.

In short: Home Office is three machines in one: a fax machine, answering machine, and data modem. The card is easy to install, and the Windows-based software can keep you in touch when you're away from the office.

420 ON READER SERVICE CARD

Notebooks

PC Brand LeaderBook: Passive Color Under $2,600

BY EMERSON A. TORGAN

If you want a color notebook but don't want to spend top dollar for an active-matrix display, take a look at PC Brand's 486SLC Color LeaderBook. Priced at $2,595, the 6.2-pound LeaderBook has a 9-inch VGA passive-matrix LCD that provides 640-by-480 resolution. It is powered by the Cyrix 486SLC processor running at 25 MHz, and ships in standard configuration with 2MB RAM (expandable to 18MB); a 3.5-inch, 1.44MB floppy disk drive; and an 80MB hard disk.

The system has one parallel port, one serial port, an external VGA port, and an external keyboard connector. An optional docking station (two drive bays and three expansion slots) and an internal fax/modem are available.

Like all passive-matrix LCDs, the display of the LeaderBook is prone to ghosting under Microsoft Windows (ghost images at the corners of dialog boxes), and the mouse cursor is easily lost when the mouse is moved quickly.

The system turned in average scores on most of our benchmark tests, though it was below average in our disk test. Battery life (or lives—the LeaderBook has two) was good, with the two batteries lasting a combined total of 2 hours 5 minutes with all power-conservation features turned off. When one battery expires, the system automatically switches over to the second without interruption. You can expect over 3 hours of computing when using power-saving features that slow the processor speed or blank the screen.

LEADERBOOK: *Price break on color.*

The trackball found in the upper-right corner of the system is a nice try, but not something you would want to use for more than half an hour. First and foremost, if you are left-handed, you're out of luck. Second, as with most small trackballs, cursor control is a bit of a problem.

The keyboard features cursor keys in the preferred inverted-T layout but does not have separate PgUp, PgDn, Home, and End keys. A set of smaller function keys resides above the keyboard.

The most notable thing about the otherwise average LeaderBook is its low price tag of $2,595—less than you would pay for most 386SL-based passive-matrix systems. If you must have color but aren't willing to pay a high price, you may find that this system is good enough.

• List price: *PC Brand 486SLC Color LeaderBook, with 2MB RAM, 80MB hard disk, DOS 5.0, Microsoft Windows 3.1, carrying case, $2,595. PC Brand Inc., 405 Science Dr., Moorpark, CA 93021; 800-722-7263, 805-378-7848; fax, 800-722-7392.*

Circle 432 on reader service card

Reference

Zagat Meets Maps in Informative CityGuide Series

BY DON WILLMOTT

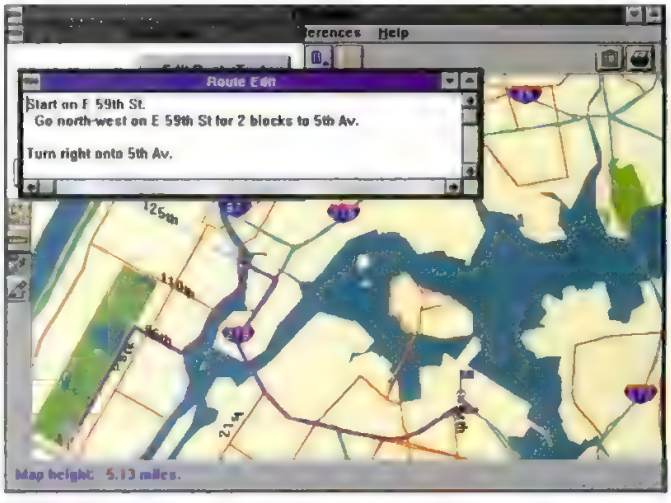
Are there any romantic French restaurants with fireplaces within a mile of the New York Hilton? And, by the way, is that a good hotel? How do you get there from the airport?

You can ask a native New Yorker these questions, or you can ask Axxis Software's CityGuide, a $99 program that tells you all about the hotels, restaurants, and landmarks of New York, Los Angeles, or Chicago (you can get all three for $249). And since it includes detailed maps, CityGuide can also show you how to get anywhere you need to go and can even give you printed driving instructions.

The real highlight of the program is the renowned Zagat Guide. Compiled from questionnaires filled out by thousands of people rather than from professional reviewers, Zagat is an honest, opinionated, and witty collection of hundreds of restaurant and hotel reviews.

Having this information available electronically is great. The restaurant listings can be sorted by ethnic type, price, location, Zagat ranking, and by any of two dozen other special categories like "quiet conversation" or "game in season." It's easy to pinpoint the one place that matches your desires.

Then the Axxis side of the program, namely the maps, can show you how to get there. Based on data from Etak Inc., the colorful area maps can locate any address in the city or region, zoom in or out at several levels, and overlay hotels, restaurants, and landmarks. You can drag the map around with a hand icon or locate a point and have the map center on it. The screen redraws slowly every time you zoom or move the map.



WAY TO GO: *CityGuide can find an optimal driving route.*

Finding an auto route from point A to point B is as easy as typing in addresses or planting a flag at your starting point and another at your destination. A line showing the route appears on the map, and you can print it out along with directions (always optimized for cars, not pedestrians). However, if you don't configure the route-optimization feature correctly, it can be very slow.

Though the maps are fun, the best reason to get one or all of the CityGuides is to have those excellent Zagat reviews just a few mouse clicks away.

• List price: *CityGuide, $99 each; three for $249.* Requires: *2MB RAM, 5MB hard disk space, Microsoft Windows 3.0 or later. Axxis Software Inc., 644 Haverford Rd., Haverford, PA 19401; 800-394-3549, 215-896-0576.*

Circle 417 on reader service card

DEMAND PERFORMANCE

Introducing Paradox 4.0 for DOS

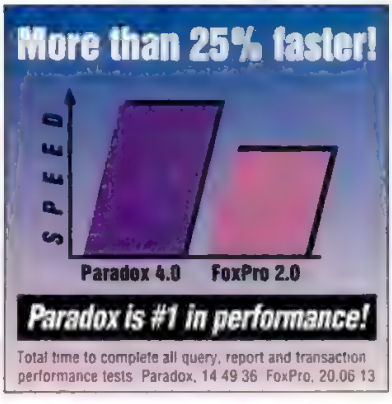
The most advanced database is now the fastest

DEMAND

Paradox is fastest

InfoWorld (September 1992) tests prove new Paradox® 4.0 is the world's fastest relational database! Thanks to Borland's new WarpSpeed™ performance, Paradox 4.0 sets the standard in performance for both network and standalone use. For you, this means faster answers to queries, faster memory access and faster multi-user applications.

In fact, Paradox 4.0 gives you unparalleled performance throughout all aspects of database management and application development. As *InfoWorld* put it, "Paradox is the hands-down winner, not only in speed, but in maintaining an amazingly consistent performance as the tests became more complex."



"Tuned-up Paradox 4.0 speeds past FoxPro 2.0."
InfoWorld *product comparison, September 28, 1992.*

New Windows-like interface

Our new Windows-like interface makes using Paradox 4.0 more intuitive than any other database. Context-sensitive SpeedBar™ controls give you instant access to your frequently used commands and features. Movable, resizable windows, pull-down menus and mouse support make creating and editing your database simple. And new dialog boxes give you the choices you need in one place, saving time and effort.

The fastest way to get an answer

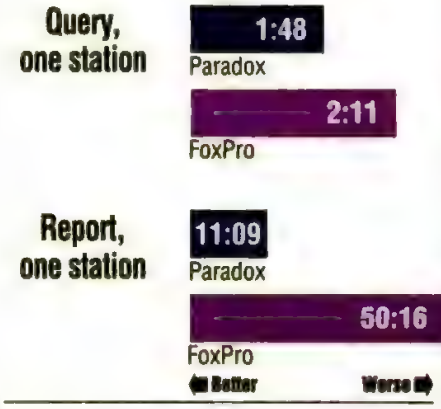
Paradox pioneered Query By Example (QBE), the easiest way to get answers from your database. Now, a built-in query optimizer enhances QBE, automatically finding the fastest path to the answers you're seeking. Plus, multi-table forms and reports make everything from data entry to presentations a snap—all without programming.

WarpSpeed

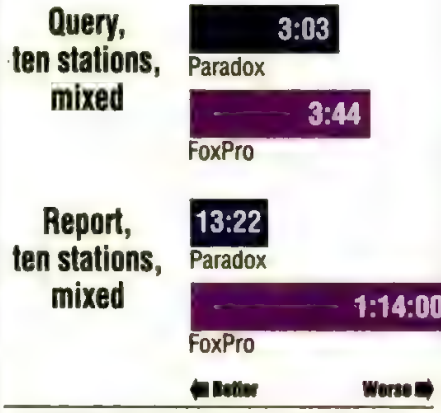
WarpSpeed stands for Wildly Accelerated Relational Performance. It reflects Borland's commitment to performance, and is also an integral part of our dBASE® and InterBase™ development programs.

InfoWorld tests confirm Paradox 4.0: Quicker than a Fox

Single-user performance tests
(minutes and seconds)



Multiuser performance tests
(hours, minutes and seconds)

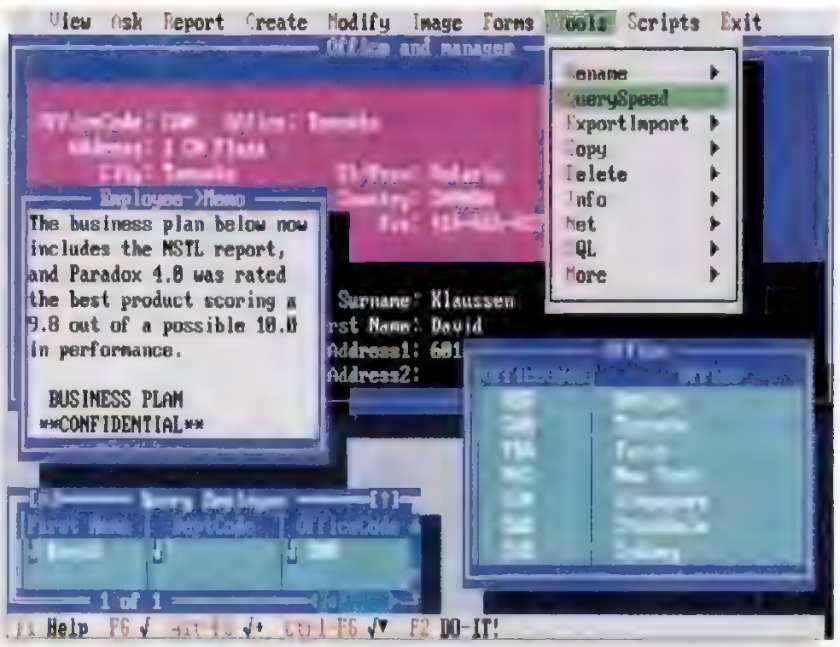


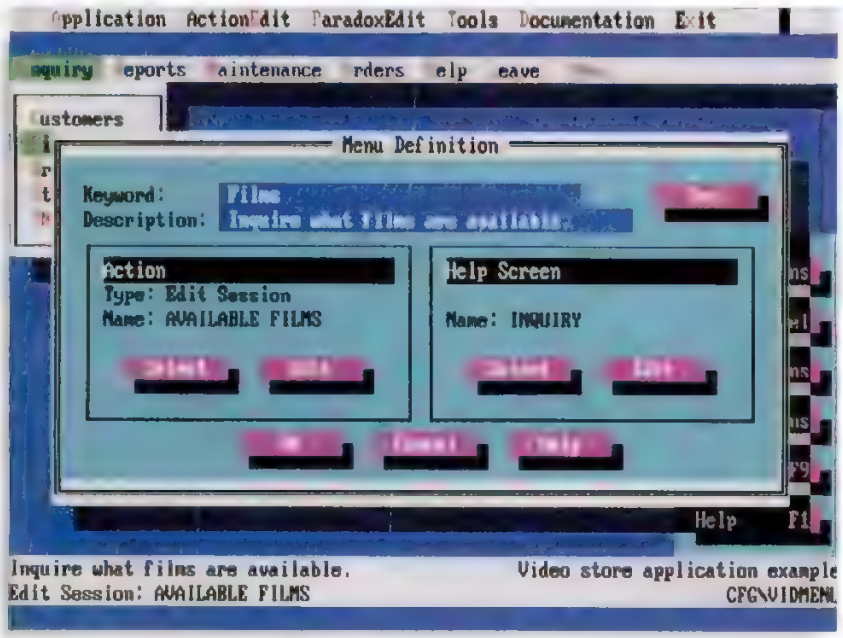
InfoWorld *created a basic file maintenance form for the sales representatives and customers who required multi-table lookups and updates. Benchmarks were conducted while 1 and 10 workstations were active on the network.*

PARADOX

New memo fields

Paradox 4.0 gives you the power to manipulate data you couldn't manage with ordinary databases. With new variable-length memo fields, you have the ability to effortlessly manage large amounts of text information throughout your applications. And you can store anything you want in the new binary field—word processor documents, sound, bitmapped graphics, multimedia data—and then manipulate it under program control. Each can hold up to 256Mb of data per field—up to four gigabytes per table! There's no easier way to manage large applications.





With the new Applications Workshop, you can build complete applications that include pull-down menus, mouse support, transparent multiuser edit sessions and more. Best of all, it's simple!

Efficient memory management

Paradox 4.0 gives you the best way to manage memory. VROOMM™ with Turbo Drive™ provides more available memory and more efficient memory utilization. So Paradox 4.0 runs on any 286 PC or above. In addition, Paradox 4.0 can run as a DOS application under the Microsoft® Windows operating environment, thanks to complete DPMI support.

DEMAND

The most award-winning database

Since its introduction, Paradox has won more awards for technical excellence and customer satisfaction than *any* other database. Awards from every major computer magazine and periodical from around the world. In fact, in a recent survey by *Computer-World*, Information Systems professionals ranked Paradox as having the best technology, best documentation, best service and support, and best price performance. All of which have made Paradox the favorite of users and developers alike.

BEST TECHNOLOGY
BEST SERVICE/SUPPORT
BEST DOCUMENTATION
BEST PRICE/PERFORMANCE

Faster network performance

Paradox 4.0 is the fastest multiuser network PC database ever. And it's network-ready right out of the box. Multiple users can read, write and modify data simultaneously. You get all this, plus new automatic group lock security that allows multiple users to share data flexibly, providing dramatically increased performance. Just another reason Paradox 4.0 is the best investment for your business.

Transparent access to SQL data

With Paradox SQL Link (sold separately), you can seamlessly access remote SQL data. You can then work with this data using standard Paradox features such as Query By Example. Paradox does all the translation for you.

Paradox SQL Link completely shields you from the intricacies of PC and database server communications. When you specify an SQL table operation, Paradox SQL Link automatically selects the correct communications protocol, opens up

Paradox Developer's Corner

Powerful, procedural language

The Paradox Application Language (PAL™) lets you create sophisticated Paradox applications quickly. PAL procedures allow for private and global variables, array passing and variable scoping. Paradox 4.0 includes more than 90 new commands and functions.

Powerful UI controls

Easily construct your applications with a robust look and feel using the built-in UI controls: non-modal pull-down menus, dialog boxes (with push buttons, check boxes, radio buttons, pick lists, type-in lines and more), pop-up menus, mouse support and multiple overlapping windows.

Event-driven extensions

GetEvent() passes keyboard, mouse and/or system events into your procedures for dispatching. Use dynamic arrays to pass dynamically created data structures to procedures. This greatly increases the modularity and reusability of your code.

Leverage Paradox behavior

Build on Paradox's multiuser support for automatic locking, multi-table forms and referential integrity. Define special error-handling procedures to trap and process error conditions, giving you complete flexibility over users' interaction with your custom application.

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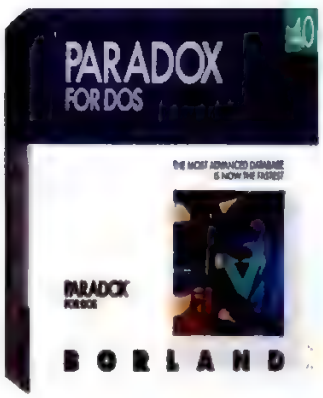
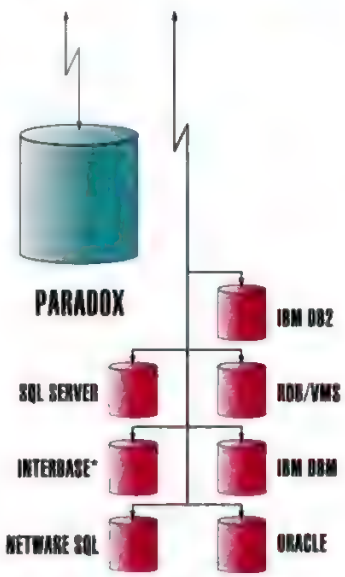
BORLAND





*Paradox SQL Link supports more industry-standard database servers than any other PC database available. (*And the InterBase SQL connection will be available soon.)*

a communication link, relays statements to the database server and presents the results of your query.

By using Paradox SQL Link, you can now enjoy the benefits of SQL databases without the difficulty of mastering the SQL programming language. In addition, Paradox SQL Link operations follow database server security restrictions.

Borland—the database leader

Borland is the acknowledged leader in PC relational databases. More users and developers trust their data to Borland products than any other company. And an integral part of that trust is Paradox.

Paradox 4.0's power to create and manage sophisticated applications, maintain data integrity, handle large quantities of data, perform complex database operations and connect to corporate data is critical to the success of a database management system today. No other PC database meets this challenge like Paradox 4.0—the most advanced database. Best of all, with Paradox 4.0's 90-day, money-back guarantee, you can order risk-free today. So demand the best. Demand Paradox!

90-DAY GUARANTEE MONEY-BACK

To upgrade or order, see your dealer or call 1-800-331-0877, ext. 5853 today!

Canadian customers call 1-800-461-3327.

BORLAND

Software Craftsmanship

See us at COMDEX booth #1178

CIRCLE 303 ON READER SERVICE CARD

Image Editing

PhotoMagic: Sharp Interface For Image Manipulation

BY BARRY SIMON

With 90 percent of the features at a third of the price of their professional counterparts, low-cost image-editing packages have been one of the hottest software categories of 1992.

The newest competitor is Micrografx's $149 PhotoMagic for Microsoft Windows, which is poised to battle ZSoft's $199 PhotoFinish. PhotoMagic has much in common with Micrografx's high-end $495 Picture Publisher, but it lacks color separation, scanner calibration, sophisticated selection tools, texture painting, and feather controls.

You'll find the basic Micrografx interface: on the left, a column of tools (in this case, selection, paint, lines, fill, text, and eyedropper) and a set of tool-dependent drop-down lists under the menu bar.

The program goes beyond these basics, however, with a set of interface controls on the right. First, matching a similar feature long unique to the ZSoft products, you can pop up a zoom box with a small, complete image, with which you control what part of the full image can show.

Also on the right is a column of thumbnails of the open images; switching between open images is as simple as clicking on the desired thumbnail. By default, images take up the full area surrounded by the frame of controls.

Even better, the File Open dialog brings up thumbnails of the images in the directory chosen. You can keep the 200-plus sample-photo images on floppy disks, while storing thumbnails on your hard disk. The program will tell you which floppy to use to recover the full image.

Selection tools include a magic wand (which selects on the basis of color changes); one-level color masks; and utensils that resize, move, skew and even rotate pieces of the mask.

Selected areas or the whole image can be modified with a variety of filters. There is scanner support, although you'll need a TWAIN driver for your scanner. To the usual bitmapped image types is added support for JPEG and Kodak PhotoCD. You can enter text in any TrueType or (if you have ATM) any Type One font.

PhotoMagic is the image editor that all but the dedicated professional will want.

• List price: *PhotoMagic for Microsoft Windows, Version 1.0, $149.* Requires: *4MB RAM, 4.5MB hard disk space, Windows 3.1. Micrografx Corp., 1303 Arapaho, Richardson, TX 75081; 800-733-3729, 214-234-1789; fax: 214-234-2410.*

Circle 421 on reader service card

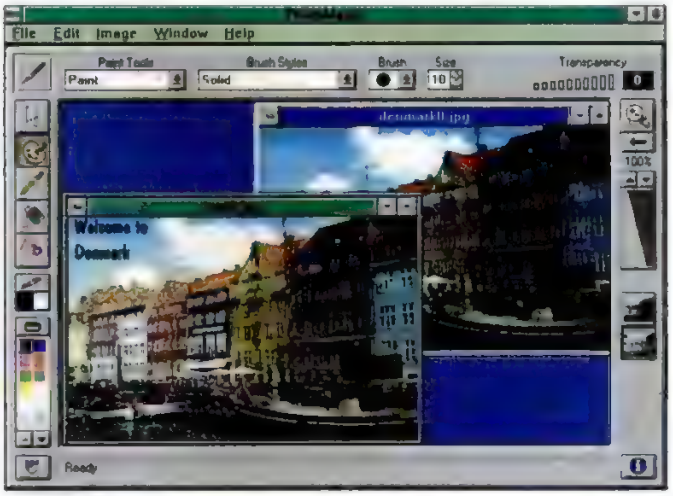


IMAGE EDITING: *The photo on the right has been sharpened and lightened, and text has been added.*

Multimedia

MCS Stereo Takes Control of All Your Sound Files

BY MARK BROWNSTEIN

Priced at just $79.95, Animotion Development Corp.'s MCS Stereo is a no-brainer gift for any audiophile on your holiday shopping list, or even for yourself. The package provides sophisticated controls over CD-ROM, .WAV audio, MIDI sound files, and even over auxiliary inputs into a sound board.

The impressive interface looks just like a high-end audio component system. It includes an audio mixer that lets you adjust left-right channel balance and input volume for each of many sources. A master volume control lets you adjust the output of your mixed audio production, and a CD player lets you play your audio CDs with all the buttons you'd find on a real CD player.

The digital recorder can be used to record to an installed sound board, providing a really easy way to master the often confusing recording functions provided with some sound boards. In addition to recording audio from microphones or external audio sources, the recorder has a .WAV file editor with controls that are so sophisticated some users may find them baffling.

But there's even more functionality. Included as a component of the MIDI module, digital recorder module, and CD module is a database manager that logs an extended name and description of each sound file. You can use it to build a play list for each device.

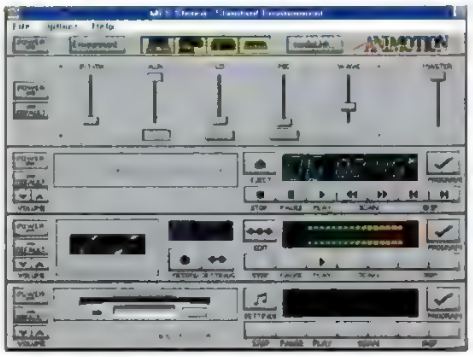
One step beyond the individual data lists is a feature called MCS MediaLink, which takes the standard data files and carries them a few steps further. In addition to letting you catalog your multimedia files, external sources like phonograph records can also be cataloged. MediaLink's search engine lets you enter search data and finds the matching record, CD, .WAV, or MIDI file.

All the modules can be minimized so that you can play your CDs, .WAV, or MIDI files in the background while you do other things. When a module is minimized, a timer showing playing time appears.

No matter what your setup, if you do anything with sound files, MCS Stereo is a great tool for controlling them.

• List price: *MCS Stereo, Version 1.0, $79.95.* Requires: *2 MB RAM, 5 MB hard disk space, Microsoft Windows 3.1. Animotion Development Corp., 3720 Fourth Ave. South, #205, Birmingham, AL 35222; 205-591-5715; fax, 205-591-5716.*

Circle 422 on reader service card



CONTROL: *MCS looks like a high-end stereo.*

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Emerson Andrew Torgan

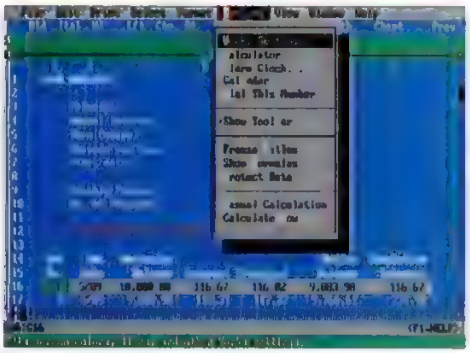
IMPROVED

Microsoft Updates Its Integrated Workhorse

Microsoft has unveiled Microsoft Works for DOS, Version 3.0, the company's venerable integrated word processing, spreadsheet, database, and communications software package. The update features a Toolbar and WorksWizards for interactive training, as well an appointment calendar and utilities such as an alarm clock, a calculator, a phone dialer, macros, and DOS file-management commands.

WorksWizards, essentially interactive help templates, give first-time users step-by-step instructions for basic functions such as creating an address book or printing mailing labels. The Toolbar lets you perform functions such as spell-checking and formatting by clicking on the appropriate icon. Additional enhancements include improvements to the word processor module, which now has the ability to hot-link spreadsheet data and charts, create footnotes, and insert graphics into documents. The spreadsheet size is larger and has a new Autosum and best-fit column-width feature. You can also view spreadsheet data graphically using charts including pie, bar, line, area, and hi-lo combination that are now accessible with the Toolbar. Enhancements to the database module include expanded record storage, and the communications module now supports COM3 and COM4 as well as a number of popular communications protocols such as XMODEM, YMODEM, ZMODEM, and Kermit.

• List price: *Microsoft Works for DOS, Version 3.0, $149; update for current users, $49. Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-429-9400, 206-882-8080.*
Circle 402 on reader service card



Works for DOS 3.0 has a GUI-like interface.

HOT PROSPECT

Worried About Your PC Being Stolen? Call the COP

High-tech equipment such as PCs are prime targets for theft. **IDX Technologies** has introduced a product that is both a theft deterrent and an owner identification service for stolen PCs recovered by law enforcement agencies

Computer Owner Protection (COP) is code-bearing software that makes PCs identifiable by hiding a small identification program on the system's hard disk. You load the program from a floppy disk, entering user identification information as prompted by the installation program. During the setup, an 11-digit code number is assigned, and the information is stored on both the hard disk and the floppy disk. Once installation is complete, you send the disk back in its supplied mailer to IDX's International Computer Recovery Center, where it is entered into a central database

According to IDX Technologies, law enforcement officials say that the majority of desktop PCs stolen are recovered without their monitors. IDX has the solution: a tone system that plays ID information through a PC's internal speaker. ICRC's decoding computer reads the tones over the phone and retrieves the owner record.

• List price: *Computer Owner Protection (COP), $49. IDX Technologies Inc., 14 Research Way, Setauket, NY 11733; 800-645-5404, 516-689-9866, fax, 516-689-1419*
Circle 401 on reader service card

NEW

IBM Personal Computer Company Rolls Out Premium Line

The new **IBM Personal Computer Co.** is making its first offerings hard to refuse. The fledgling spin-off has introduced a new line of PS/2s, including high-performance desktop systems and multimedia machines, a wide range of servers, new disk subsystems, and monitors. The company also broke new ground with price reductions on existing PS/2s and is backing the new line with an on-site 3-year warranty; 24-hour, 7-day-a-week toll-free telephone support (including a bulletin board and an automated fax number); and a 4-hour average service response time by IBM or its third-party service providers.

At the top of the list of new desktop systems is the PS/2 77 486DX2, based on the Intel speed-doubling 66-MHz 486DX2 processor. Two systems (the PS/2 56 486SLC2 and the PS/2 57 486SLC2) feature IBM's own speed-doubling processor, the 50-MHz 486SLC2. Rounding out the desktop offerings are two 486SXs running at 33 MHz. Four new multimedia systems (the PS/2 Ultimedia M57 486SLC2, PS/2 Ultimedia DV M57 486SLC2, PS/2 Ultimedia M77 486, and the PS/2 Ultimedia 77 486DX2) are also available. All of IBM Personal Computer Co.'s new offerings are preloaded with OS/2 2.0, and have the noninterlaced graphics of Extended Graphics Array-2 (XGA-2), 8MB RAM standard, a 2.88MB floppy disk drive, Micro Channel Architecture, and a SCSI interface.

• List price: *PS/2 56 486SLC2 with 8MB RAM, 2.88MB floppy disk drive, 104MB hard disk, $2,265; PS/2 77 486DX2-ONF with 8MB RAM, 2.88MB floppy disk drive, 400MB hard disk, $4,680. IBM Personal Computer Co., Route 100, Somers, NY 10458; 800-772-2227.*
Circle 403 on reader service card

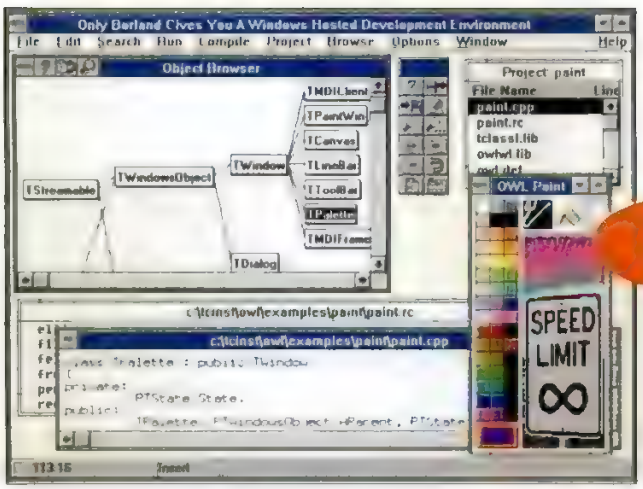
IMPROVED

Windows Database Front-End Gets New Features

Approach Software is shipping an update to its combination Windows relational database/front end: Approach for Windows, Version 2.0. The new version has PowerKeys to SQL Server and FoxPro, letting you work with

Photography by Thom O'Connor

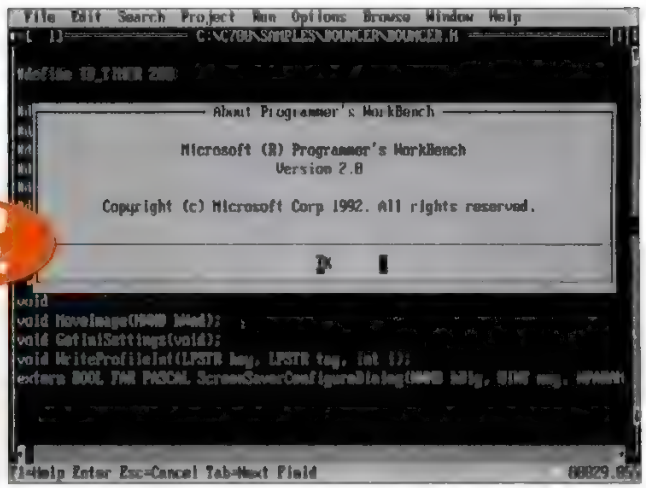
BORLAND C++ DOES



Borland C++ & Application Frameworks

Streamline your development cycle by creating Windows applications within the graphical Windows environment.

VS.



Microsoft C/C++

Why write a Windows application using character-mode DOS? *It doesn't make sense.*

Real programmers speak out on Borland C++ vs. Microsoft C/C++

"My level of productivity with Borland's products is way beyond what I get out of Microsoft's products." —Larry Skinner, Kingsport, TN

"Borland® C++ is a superior development tool. The integrated development environment is programmer intuitive and developer friendly. . . . Borland just plain offers developers more options and better quality." —Thomas Jonas, Minneapolis, MN

"When I installed the program [Microsoft C/C++], it corrupted my Windows program manager and it took me five hours to get it working again. I then realized I had made a mistake. I just cannot believe that the people who invented Windows would have a development program that does not run in Windows." —Barry Bowen, Memphis, TN

"We bought it [Microsoft C/C++] because of the low price but we gave up on it after two weeks of frustration." —Jeffrey Kho, Fremont, CA

"Our Windows development team is trying to gear up for our move from C to C++. Borland's third-generation C++ compiler gives us a lot more confidence to make the move to C++ than the first-generation C++ attempt from Microsoft." —John Ferguson, Springdale, AR

"The Programmer's Workbench (PWB) in Microsoft® C/C++ is a cruel joke. I can't believe that Microsoft has the gall to tout 7.0 as a wonderful Windows development environment when the PWB proves that they can't manage to write a decent development environment." —Ron Sproul, Seattle, WA

"There's no support for OS/2® [in Microsoft C/C++] even planned, and the default install on my system failed to compile the example programs!" —Steven C. Stambach, Fresno, CA

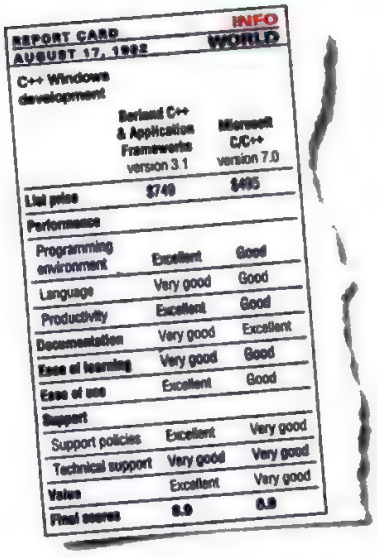
"After using both Microsoft and Borland products throughout the years, I am convinced that Borland has . . . the best value for the customer." —Mark Cooperstein, Kingsport, TN

"PWB (Programmers Workbench), CodeView—the entire development environment is pathetic! MS-C7 cannot install from an alternative drive. CodeView does not run in standard mode. Bottom line is that it [Microsoft C/C++] is frustrating every step of the way." —Arthur Applegate, Redmond, WA

"The Microsoft Foundation Classes (MFC) is difficult to use if you are new to Windows. The compile times are slower than C 6.0. And the most aggravating thing was that MS charged me extra for the SDK documentation." —Larry Skinner, Kingsport, TN

"Borland's consistent quality makes it easy to use and recommend their products. This level of quality is a target we strive for in the products we produce. Our tool has become our goal!" —Scott Wallace, Oklahoma City, OK

WINDOWS BETTER!



REPORT CARD — AUGUST 17, 1992 — INFO WORLD

C++ Windows development

	Borland C++ & Application Frameworks version 3.1	Microsoft C/C++ version 7.0
List price	$749	$495
Performance		
Programming environment	Excellent	Good
Language	Very good	Good
Productivity	Excellent	Good
Documentation	Very good	Excellent
Ease of learning	Very good	Good
Ease of use	Excellent	Good
Support		
Support policies	Excellent	Very good
Technical support	Very good	Very good
Value	Excellent	Very good
Final scores	8.9	8.8

These programmers have learned that the best tools for Windows don't come from the company that makes the operating system. They come from the company that makes the best Windows and DOS compilers—Borland.

With Borland® C++ you get a complete Integrated Development Environment (IDE) for Windows and DOS. Your development cycle is streamlined because you can create, edit, and run your Windows applications all from within a graphical Windows environment.

You'll love the convenience and power of the IDE, with its special features like the ObjectBrowser™ to show you class relationships and help you navigate through your code, and the special SpeedBar™ for instant access to commonly used functions.

Integrated Resource Workshop

VS.

disintegrated SDK

With Borland's Resource Workshop you can create Windows resources quickly and easily. You just "draw" great-looking Windows resources like dialog boxes, buttons, icons, and more. It's infinitely simpler than wrestling with the SDK.

Write less code

VS.

write more code

Borland's Application Frameworks™ let you "bolt on" a complete user interface with just a few lines of code. Our ObjectWindows™ high-level objects give you graphical user interfaces with far less code than the low-level Microsoft Foundation Classes. And Turbo Vision™ gives you great ready-to-plug-in user interfaces in character mode for DOS.

Powerful tools

VS.

wimpy tools

Borland C++ gives you a complete selection of the finest tools. Turbo Debugger® for Windows and DOS debugs code fast. Turbo Profiler™ pinpoints bottlenecks in your code. WinSight™ helps monitor Windows activity. And you also get object-oriented Turbo Assembler® and more than 4,500 pages of clear, comprehensive documentation.

Full C++

VS.

partial implementation

Full language compliance is key in a compiler and only Borland complies with AT&T's CFRONT 3.0 C++ standard. Only Borland gives you templates so you can create reusable code for the container classes and other parameterized types.

Third-generation

VS.

first attempt

Borland's third-generation C/C++ compiler brings you the power and reliability that only comes with experience. Borland gives you a faster C/C++ compiler with great features like a smart project manager and automatic, safe precompiled headers. Just some of the many reasons why we've sold more than 700,000 C/C++ development systems to professionals worldwide.

Go with the best

The best C and C++ tools for Windows are from the leader in Object-Oriented Programming. Trust your code to Borland. See your dealer today, or

call 1-800-331-0877, ext. 5387.

In Canada, call 1-800-461-3327.

Call now and we'll send you a free technical white paper revealing the honest comparison of Microsoft C/C++ and Borland C++.

PC WEEK LABS ANALYST'S CHOICE — June 10, 1991 — Borland C++

PC MAGAZINE EDITORS' CHOICE — July, 1992 — Borland C++ & Application Frameworks 3.0

WINDOWS SOURCE RECOMMENDED PRODUCT — February 3, 1992 — Borland C++ Windows Development

PC WEEK LABS TOP PRODUCTS OF 1991 — December 23/30, 1991 — Borland C++

1991 BYTE AWARD OF DISTINCTION — January 1992 — Borland C++

INFO WORLD PRODUCT OF THE YEAR 1991 — March 23, 1992 — Borland C++

See us at COMDEX booth #1178

BORLAND

The Leader in Object-Oriented Programming

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CIRCLE 295 ON READER SERVICE CARD

that data in its native format and mix it with dBASE, Paradox, or Oracle SQL data on any report or form. DB2 data can be accessed in its native format via the third-party Micro-Decisionware gateway, and support for dBASE and Paradox indexes provides consistent performance by automatically updating dBASE, FoxPro, and Paradox indexes when modifying records, according to the company.

Approach for Windows, Version 2.0, has more than 50 new features in total, including an automatic mail-merge, new database management features such as drag-and-drop and a "sounds-like" phonetic-search capability; enhanced security features such as read-only fields and user-defined record locking; and Windows 3.1 features such as common dialog boxes, TrueType, and OLE (Object Linking and Embedding).

• List price: *Approach for Windows, Version 2.0, $399; upgrade from Version 1.0, $49. Approach Software Corp., 311 Penobscot Dr., Redwood City, CA 94063; 415-306-7890; fax, 415-368-5182.*

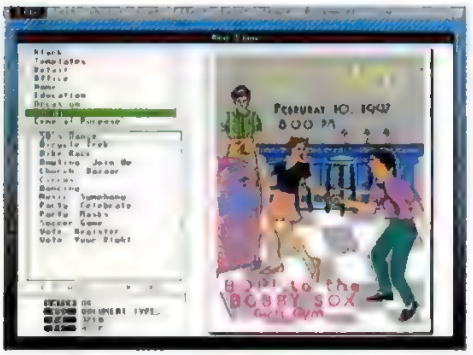
Circle 404 on reader service card

NEW

Why Go to Art School in Paris? Instant Artist is Here

Okay, we're not talking about Monet on disk. Nor are we talking about crayons, construction paper, kiddie scissors, and paste. What we are talking about is Instant Artist, Version 1.0, from **Autodesk Retail Products Division.** Available in DOS and Windows versions, Instant Artist lets you create signs, banners, greeting cards, letterheads, business cards, envelopes, postcards, and certificates without drawing tools.

The main view of the program lets you choose from signs, banners, and the like, and then you scroll through a selection of predefined layouts. A preview window lets you select your choice. Each category contains a blank menu selection for those who choose to design their own layouts in conjunction with the program's library of graphics, templates, borders, background fills, textures, special effects, and fonts. Predesigned layouts are made to be customized, and a "hot preview" feature lets you see the effect before editing the image, reducing screen redraw time. Special effects include rotation, mirror images, shadows, zooms, arcs, and three-dimensional effects.



It's not Louvre-quality, but it does the job.

• List price: *Instant Artist, Version 1.0 for DOS, $89.95; Instant Artist, Version 1.0 for Windows, $139.95. Autodesk Retail Products Division, 11911 N. Creek Parkway South, Bothell, WA 98011; 800-228-3601, 206-487-2233; fax, 206-483-6969.*

Circle 405 on reader service card

BRIEFS

NETWORKING AND CONNECTIVITY

Artisoft is shipping the LANtastic for Macintosh connectivity system, available in two versions: a complete hardware and software solution ($799), or a software-only kit ($599). The kit provides a peer-to-peer solution for Macintoshes on PC networks. LANtastic for Macintosh includes software, a Local Talk adapter card, and cabling. The software-only kit includes the software as well as driver programs for EtherTalk, Local Talk, and Token-Ring adapters. 800-846-9726, 602-293-4000; fax, 602-293-8065

David Systems Incorporated (DSI) is shipping ExpressView Companion ($1,495), its new network management software package. ExpressView Companion provides network configuration management, software scanning, support for Novell's LANtern databases, TCP/IP address management, and UPS status tracking features 800-762-7848, 408-720-8000

Emerald Systems is now shipping its Windows-based network backup and data storage management software, Xpress Librarian, Version 2.0 ($995). Supporting NetWare 2.15 or later and DOS 3.3 or later, Xpress Librarian runs under Windows 3.x, letting network administrators perform backup, restore, and data-storage functions. The software operates with the company's line of tape drives. 800-767-2587, 619-673-2161; fax, 619-673-2288

Invisible Software has released InvisibleLAN 3.13 ($99), an upgrade to its peer-to-peer network operating system (formerly named NET/30). The new version includes the following features: TCP/IP connectivity; an enhanced print server for direct printing without spooling; real-time browsing of network utilities; a user activity log; a network bulletin board with storage and forwarding facilities, and reply tracking. 407-260-5200

Magee Enterprises is shipping Network H.Q., Version 2.5 ($395 for 100 users), which now supports Microsoft LAN Manager, VINES, and most popu-

NEW

When Lightning Strikes in Windows, Speed is the Result

Lucid Corp. is shipping Lightning for Windows, Version 1.0, a disk-caching program configurable from within the Windows environment that promises as much as a 93 percent increase in Windows performance, according to the company. It features CD-ROM caching and dynamic memory sharing, running Windows at optimal speed by automatically "loaning" part of its cache buffer when applications require more memory.

Lightning for Windows provides 20 different disk-caching options, and the program lets you display such system information as memory and disk accesses. It ships with a collection of utilities that includes "Kazoomer," which magnifies a portion of the screen; a collection of screen savers; and "Piranha," a drag-and-drop file-deletion utility.

• List price: *Lightning for Windows, Version 1.0, $129.95. Lucid Corp., 101 W. Renner Rd., #450, Dallas, TX 75082; 800-925-8243, 214-994-8100; fax, 214-994-8103.*

Circle 406 on reader service card

NEW

HP Rolls Out Low-Priced, Network-Ready Systems

Hewlett-Packard is joining the value-priced PC fray. What it brings to the battleground is the HP Vectra 486N PC series, with prices starting as low as $1,149 for a 486SX-based system running at 25 MHz (with no floppy disk drive or hard disk). The top-of-the-line system is a $3,099 66-MHz 486DX2–based unit with one floppy disk drive and a 170MB hard disk. The processor-upgradable 486N systems come standard with 4MB RAM and the HP Ultra VGA+, an S3 86C911based, 32-bit lo-

cal-bus video implementation for accelerated graphics performance. The systems are available preconfigured with an HP EtherTwist or Token-Ring interface card, and are certified to run under network operating systems such as Novell's NetWare, Banyan's VINES, and The Santa Cruz Operation's SCO Unix. They have multilevel security features and diagnostic software as well as on-line help in ROM.

• List price: *HP Vectra 486/25N Model 0 (no floppy disk drive and no hard disk), $1,149; HP Vectra 486/66N Model 170 (with one floppy disk drive and a 170MB hard disk), $3,099. Hewlett-Packard Co., Direct Marketing Organization, P.O. Box 58059, MS511L-SJ, Santa Clara, CA 95051; 800-752-0900.*

Circle 407 on reader service card

IMPROVED

MicroPhone Pro Makes Faxing Documents a One-Step Process

Software Ventures has unveiled an integrated communications package for Windows that combines fax capabilities, multimedia support, and interactive telecommunications. MicroPhone Pro for Windows offers a scripting language and support for Windows 3.1, and provides a simple drag-and-drop interface for sending and receiving documents as faxes or e-mail messages. The package integrates Delrina Technology's WinFax LITE, and, via customizable fax icons, faxing to one address or to a 100-address distribution list is a one-step drag-and-drop process. The program includes an icon bar that contains customizable script buttons. Clicking a button or dropping a document on it launches the script it represents. MicroPhone Pro for Windows also features a status line, which provides updates on modem status, error messages, user-definable messages, and descriptions of menu functions. There is also a dialing directory that automates dialing, redialing, and logging on to services and bulletin boards.

MicroPhone Pro for Windows supports the MPC standard for multimedia, which lets you compose multimedia files through CD and MIDI sources and send them as multimedia-presentation e-mail messages. The package supports Dynamic Data Exchange (DDE), the Windows Multiple Document Interface (MDI), dual file transfers, and has network support including NetWare, NetBIOS, ComBIOS, and DOS devices.

• List price: *MicroPhone Pro for Windows, $195; upgrade for current users of MicroPhone II, Version 2.0, $49.95. Software Ventures Corp., 2907 Claremont Ave., Berkeley, CA 94705; 510-644-3232; fax, 510-848-0885.*

Circle 408 on reader service card

BRIEFS

NETWORKING AND CONNECTIVITY

lar NetBIOS-, NDIS-, and ODI-compatible networks, in addition to NetWare. The new version provides an optional DOS or Windows interface and now tracks such hardware component information as CPU clock speed and MCA and EISA adapter cards. Network H.Q. 2.5 is available as a $99 upgrade from the previous version. 404-446-6611; fax, 404-368-0719.

Microcom has unveiled Carbon Copy for DOS 6.1 ($199), the latest update of its remote-control software package. It has a new installation program that is faster, and features closer integration of LAN and asynchronous capabilities. A single program now installs both the LAN and asynchronous modules. Users of Version 6.0 may upgrade free to Version 6.1 from Microcom's bulletin board service (617-551-1888). 617-551-1000; fax, 617-551-1968.

Network Security Systems is shipping LanSafe II ($135), a network power-management software program for Novell networks. LanSafe's power management features include management for every networked device, file server, and workstation; real-time configuration management of operating parameters, such as voltage ranges; and a PowerPro feature for setting upper and lower voltage limits. 800-755-7078, 619-587-7950; fax, 619-552-9162.

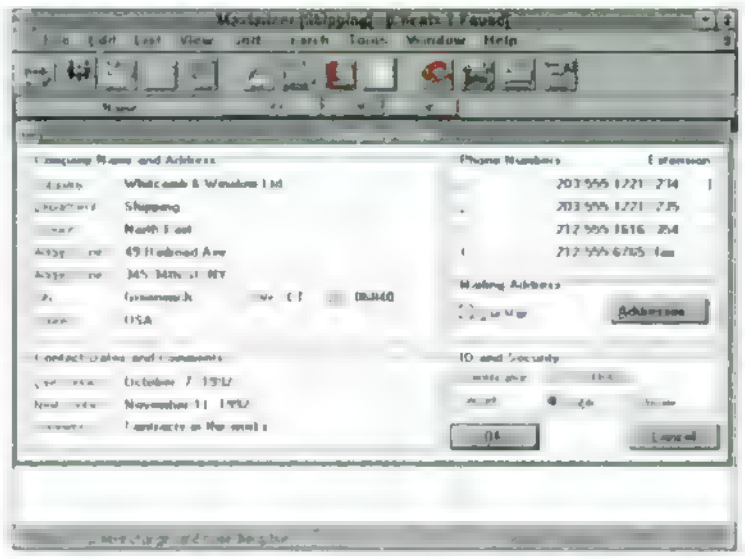
O'Neill Communications is shipping Datagram LAWN, a wireless alternative to RS232 and RS422 networks. Priced at $500 per terminal, the units link PCs and peripherals using high-frequency spread-spectrum radio transmissions. Data can be transmitted through walls and other obstructions. 908-329-4100; fax, 908-329-4101.

Penril DataComm Networks has unveiled the Module 24 ($6,000, or $1,500 per bridge port) for the Series 2500 high-performance bridging hub. Each Module 24 supports four Ethernet LANs. It is fully SNMP and MIB II compliant. 301-921-8600.

NEW

Maximizer Contact Management Software Comes to Windows

Richmond Technologies & Software is shipping Maximizer for Windows, Version 1.0, the company's first Windows-based contact management software package. It features Dynamic Data Exchange (DDE) links for automated faxing to an entire database via Delrina Technology's WinFax Pro, or for mail-merge operations with DDE-compliant applications. Support for the Windows Multiple Document Interface (MDI) lets you open up to nine separate windows for each program component of the package and drap-and-drop information between them. A multifunction "Hotlist" features pop-up tables that let you prioritize tasks and mark them as completed, with unmarked tasks moving to the next day's list. Contacts can be dragged and dropped onto the hot list, and all auto-dialing, document writing, reporting, and printing functions can be accomplished directly from the "Hotlist."



Maximizer has DDE links for automated faxing.

• List price: *Maximizer for Windows, Version 1.0, $249. Richmond Technologies & Software Inc., 6400 Roberts St., #420, Burnaby, B.C. V5G 4C9 Canada; 800-663-2030, 604-299-2121; fax, 604-299-6743.*

Circle 409 on reader service card

IMPROVED

Coherent 4.0 Runs Unmodified Unix Programs

Mark Williams Co. is shipping Coherent, Version 4.0, a 32-bit clone of the Unix operating system. Coherent 4.0 (the successor to Coherent, Version 3.2) is a multiuser, multitasking operating system that has over 200 Unix commands and utilities. It provides a suite of program development, text processing, communications, and administrative tools. The new version automatically sizes the buffer cache to

Borland's

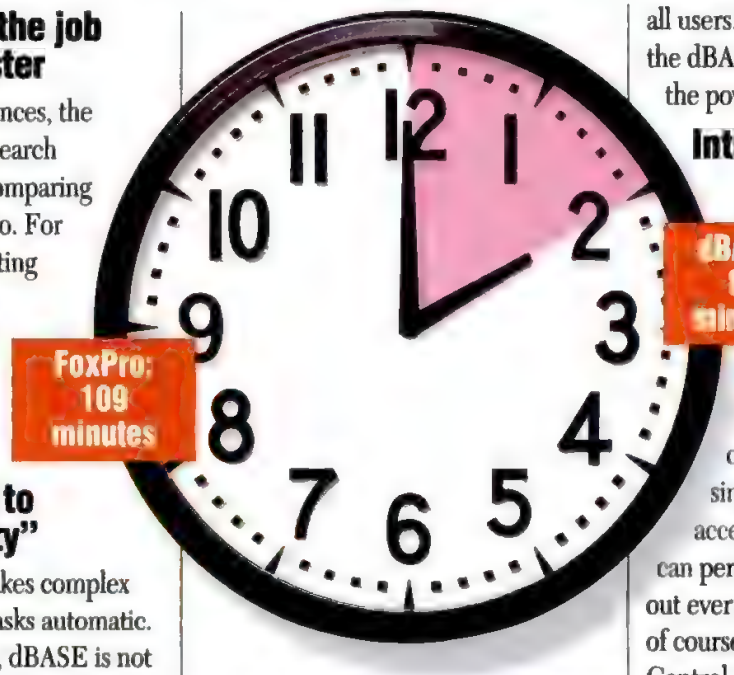
Get an extra 2 hours out

dBASE gets the job done faster

Recently, Usability Sciences, the leading productivity research firm, conducted tests comparing dBASE IV® with FoxPro. For everyday tasks like creating reports, browsing, linking, and using linked data, dBASE® users got their work done 25 percent faster.

The secret to "user-ability"

The Control Center makes complex tasks easy, and simple tasks automatic. Unlike the competition, dBASE is not merely a developer's tool. For those who *are* developing custom applications, the dBASE language sets the standard for power and productivity. But it's the dBASE Control Center that makes dBASE a favorite among all users. You don't have to learn the dBASE language before putting the power of dBASE to work for you.



dBASE takes less time to get the job done. *In independent tests using both dBASE and FoxPro, users got their work done 25 percent faster with dBASE. That's like getting an additional two hours of work done every business day. Now that's productivity!*

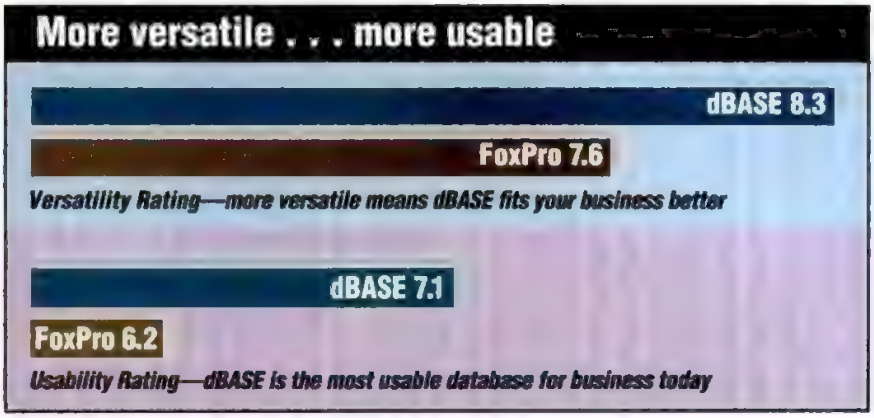
Intuitive tools eliminate guesswork

The dBASE Control Center puts you in charge, with the power to see and access everything at a glance. Its straightforward, task-oriented interface gives you single-keystroke or mouse-click access to dBASE's power. So you can perform all your daily tasks without ever seeing a dot prompt (unless, of course, you *want* to). And the Control Center's open architecture makes it easy to enhance or customize your own dBASE applications by incorporating third-party add-on products. No wonder NSTL rated dBASE tops in versatility and usability.* And why *ComputerWorld* ranked dBASE the #1 PC development tool for DBMS client/server software.

Get results fast

Powerful Design Tools let you create database tables, queries, data entry forms, reports, labels, and applications interactively. So you can see the results onscreen as you work.

Versatile Report Writer gives you the widest choice of report styles available, with many text enhancement features to add clarity to your data.



*NSTL found dBASE to be the favorite of both novice and experienced users alike in Overall Usability and Versatility.**

dBASE IV

f every business day!

I/S prefers doing usiness with dBASE

	Borland dBASE	Microsoft® FoxPro
alled in Company	#1	#5
t Technology	#1	#4
t Price/Performance	#1	#3
t Service/Support	#1	#5
t Documentation	#1	#4
er to Do Business With	#1	#4
n to Buy	#1	#4

ce 1992 ComputerWorld I/S Brand Preference Study

*latest **ComputerWorld** Preference ves show dBASE outranks the petition in 12 out of 14 categories.*

y Label Designer includes for- s for mailing labels, name badges, Rolodex cards. You name it—re only a few keystrokes or mouse es away from having it on your desk.

he world's #1 database keeps getting better

v dBASE IV comes complete with -down menus and mouse support, ou're never more than a click away n your data.

technology, dBASE's exclusive ex Query optimizer, finds the est way to get the answers you want n your database—automatically—a in the most complex network ronments. Our relational Query By mple lets you manipulate your data quickly and easily. All you have to do is select the fields you want, and *presto*—instant results!

Fast new auto-install program practically installs dBASE by itself. It has never been easier to get started with a professional database.

Sophisticated tools for power developers

Power developers will like dBASE IV's 40 work areas, IBM® SAA-compliant SQL, plus many new functions and commands. The Template Language is now included free. We've enhanced BLANK support. And dBASE's automatically generated code can be combined with your own custom programming for unmatched speed and flexibility in creating new applications.

40 Different Work Areas Now Commands

Create applications easily

Even novice users can create custom solutions with dBASE. When you're finished designing your database tables, labels, and reports, tie them all together as a complete application with dBASE's easy-to-use Application Generator. And you do it all without programming! Keeping track of your data and putting it to work for you has never been easier.

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Whether you're a database user, MIS manager, applications developer, or even a CIO, it pays to standardize on the standard.

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In Canada, call 1-800-461-3327

Call now and we'll send you the fact-filled white paper on dBASE usability, *free*!

60-DAY GUARANTEE MONEY-BACK

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Software Craftsmanship

e *Digest* Rating Report, Multiuser Database Programs, May 1992, Vol. 9, No. 2. Copyright © 1992 Borland International, Inc. All rights reserved. dBASE, dBASE IV, and IQ! are trademarks of Borland International, Inc. BI 4578

CIRCLE 285 ON READER SERVICE CARD

improve disk access speed, runs a number of unmodified Unix binaries, and produces binaries that run unmodified on other iBCS2 Unix systems. It also compiles C code and supports hotkey switching between sessions.

• List price: *Coherent, Version 4.0, $99.95; upgrade from Version 3.x, $59.95. Mark Williams Co., 60 Revere Dr., Northbrook, IL 60062; 800-627-5967, 708-291-6700; fax, 708-291-6750.*
Circle 410 on reader service card

IMPROVED

A Faster Mathematica for DOS

Wolfram Research has unveiled an enhanced version of Mathematica, featuring lower memory requirements and improved speed in functions such as calculating linear equations, rendering contour graphics, and generating PostScript graphical output. Mathematica, Version 2.1, also offers ten new Mathematica packages, including nonlinear fitting, binary file manipulation, Dirac delta functions, and sound synthesis.

Memory requirements for the program have been reduced 10 to 50 percent by optimizing the software's internal representation of expressions, according to the company. The Share function, for sharing memory between common subexpressions, has been extended, reducing memory used by an additional 30 to 50 percent. Mathematica 2.1 has a redesigned menu structure and commands grouped together on the basis of function. The Windows version has a margins ruler and a pop-up Cell Styles menu in the ruler's window, providing several shortcut buttons for frequently used menu commands.

• List price: *Mathematica, Version 2.1, $595. Wolfram Research Inc., 100 Trade Center Dr., Champaign, IL 61820; 800-441-6284, 217-398-0700; fax, 217- 398-0747.*
Circle 411 on reader service card

IMPROVED

PackRat 4.1 Gains Support for Drag-and-Drop

Polaris Software is shipping updates to its standalone and network versions of PackRat, the company's personal information manager (PIM) for Windows. PackRat, Version 4.1, now provides drag-and-drop scheduling or rescheduling, letting you drag names from the phone book to the calendar, or drag an appointment from one day and drop it on another. Two new action buttons let you print selected reports and automatically search for all items in a PackRat facility. The number of SmartButtons, or macro buttons, now numbers 24. A new Trifold report type lets you include the Things To Do List, the Contact List, and the yearly calendar in a single report. The program also ships with the PackRat Integration Library, Version 2.0, a dynamic link library that offers seven new tools. It has macros for CompuServe, Delrina Technologies' WinFax Pro, and Da Vinci Systems' e-MAIL.

• List price: *PackRat, Version 4.1 (single user version), $395; 3 user network version, $695 (each additional node $150). Polaris Software, 17150 Via Del Campo, #307, San Diego, CA 92127; 800-722-5728, 619-674-6500; fax, 619-674-7316.*
Circle 412 on reader service card

BRIEFS

NETWORKING AND CONNECTIVITY

Tutankhamon Electronics is shipping its XL (extra length) line of Ethernet repeaters that allow multiple building sites to connect 10Base2, 10Base5, 10BaseT, and the company's UTP LANs at distances of up to 1,500 feet using existing telephone wire. The XL-1500 UTP Repeater with Thinnet interface is priced at $1,999; the XL1502 2-Port UTP Repeater is priced at $1,999; the XL1503 UTP Repeater with Thinnet and AUI interface is priced at $1,499; the XL1504 4-Port UTP Repeater with Thinnet and AUI interface is $3,999. 800-988-4888, 510-682-6510; fax, 510-682-4125.

Triticom has unveiled an enhanced version of LANdecoder/tr ($1,195), its software-based LAN protocol analyzer for any 4Mb to 16Mb IBM/IEEE 802.5 Token-Ring LAN. The new version supports more than 50 LAN adapters from vendors such as Intel, Madge Networks, Proteon, and ODS. Additional enhancements buffer wrapping during capture, and trace file conversion. 612-937-0772; fax, 612-937-1998

Walker Richer & Quinn has announced Reflection 2 for Windows, Version 4.0 ($299), a VT 320 terminal emulator. The new version includes enhanced management of network connections, faster file transfers via drag-and-drop, a script recorder, and an enhanced scripting language and client/server enabling technology. 800-872-2829.

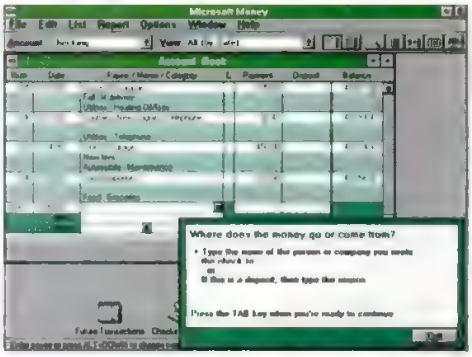
Zephyr Development has unveiled Version 3.0 of its 3270 Passport terminal emulation software ($425). The update lets PC users emulate 3270 terminals under either DOS or Windows 3.1. New features include support of both coax and Token-Ring LAN 802.2 gateways, and use of only 3.5K RAM when running DOS 5.0 or QEMM. Additional Windows emulator features include Hot Spot, Quick Pads, Scripting, support for TrueType scalable fonts, and cutting and pasting to the Windows Clipboard. 800-966-3270, 713-623-0089; fax, 713-623-0091.

IMPROVED

Money 2.0 Aims to Take the Pain Out of Money Management

Microsoft is shipping Microsoft Money for Windows, Version 2.0, featuring a new Loan Calculator and Loan Wizards, as well as charting, automatic budgeting, and Transaction Coaches that guide you through each of the program's transactions. The new version includes enhancements to existing features, such as Smartfill, SmartReconcile, and Future Transactions, which allow you to schedule recurring transactions.

Money 2.0 tracks loan transactions and balances and creates amortization schedules so



Money's Transaction Coaches get you started.

you can obtain reports on balances and interest payments. The new Loan Calculator performs various loan scenarios, and a number of loan types (car installment, home equity) can be tracked. The program offers a wide variety of custom report forms, which can be saved and exported to spreadsheets and word processors. It sorts income and expenses by individual tax-form lines and exports data to TurboTax and Andrew Tobias' TaxCut. Money 2.0 is compatible with Quicken Interchange Format files.

• List price: *Microsoft Money for Windows, Version 2.0, $69.95. Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-429-9400, 206-882-8080.*
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Introducing Quattro® Pro for Windows.

BORLAND

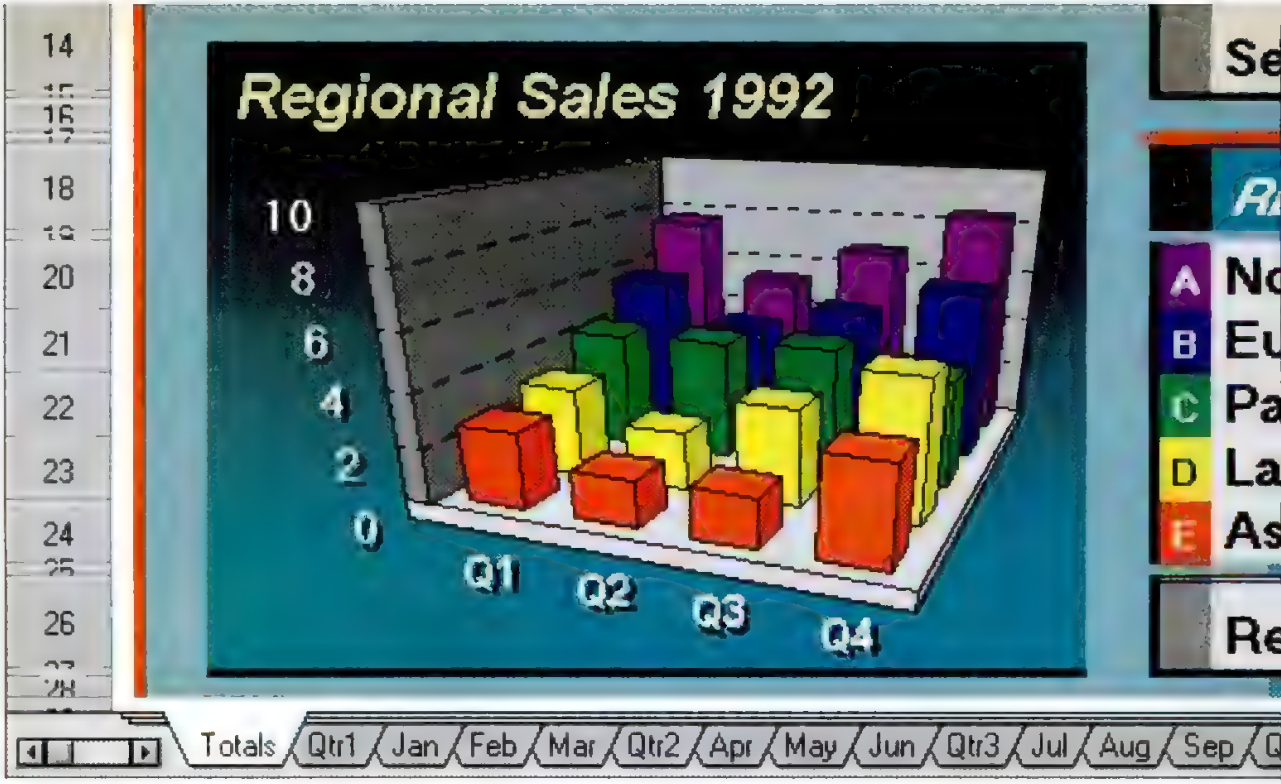
Notebooks

Object Inspector

Database Access

1-2-3 Compatibility

WinDOS Offer



...Spreadsheet

Quattro Pro for Windows *is the most usable spreadsheet ever made. Built with Borland's renowned object-oriented technology, Quattro Pro for Windows* is packed with hot new features you won't find in any other spreadsheet.*

NEW! Spreadsheet Notebooks* with customizable Tabs are nothing less than a revolution in spreadsheet ease of use. Now you can intuitively organize and manage your spreadsheet data.

NEW! Object Inspector™ menus end the hassle of searching through menus. They're simpler than 1-2-3. Just click the *right* mouse button anywhere on the screen to get a list of what you can change and change it right there.

NEW! Database Desktop is the easiest way to incorporate dBASE® and Paradox® data into your spreadsheet. Just what you'd expect from Borland, the leader in database technology.

NEW! SpeedFill™ and **SpeedFormat™** slash setup time by automatically filling in spreadsheet headings and formats.

NEW! SpeedBars™ are context-sensitive and customizable. SpeedBar icons give you pushbutton access to your most frequently used commands.

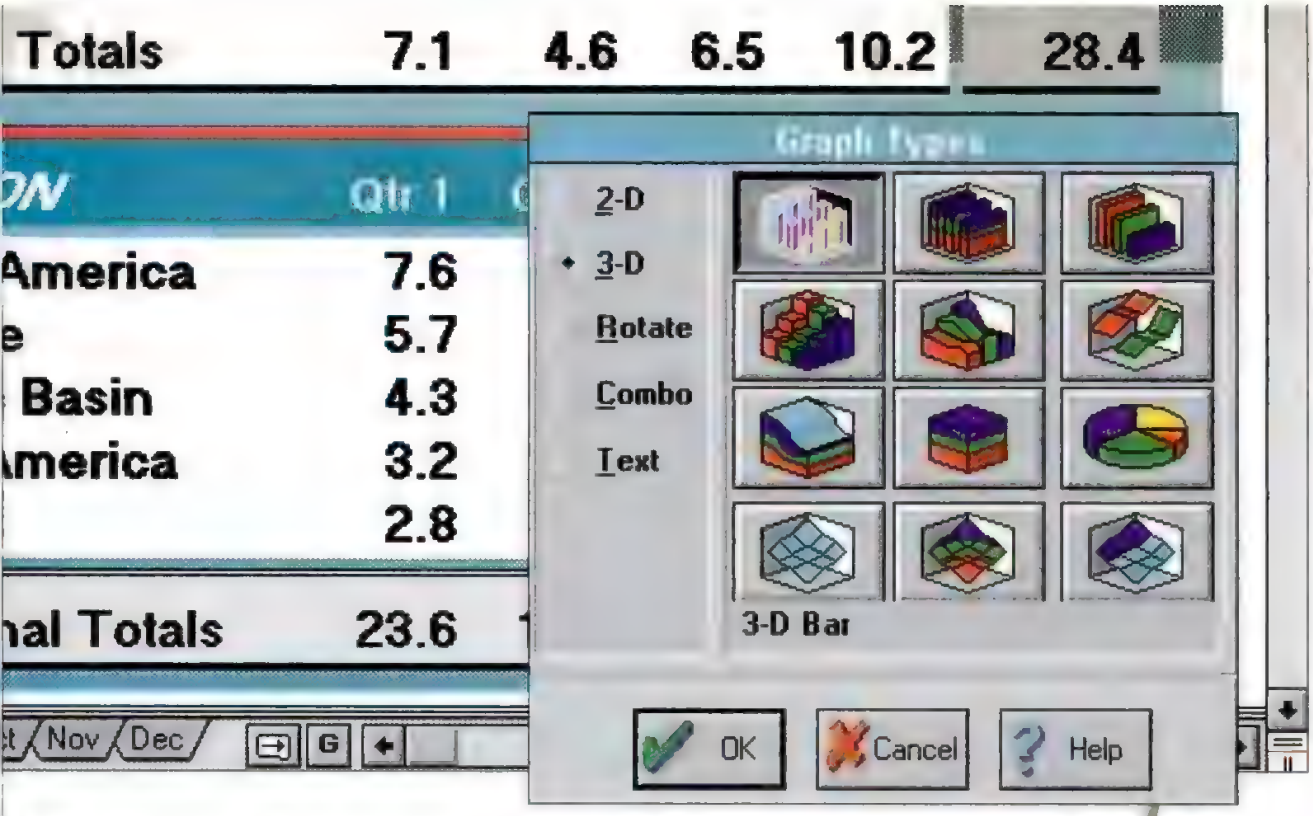
NEW! Presentation Graphics and drawing tools that rival those of Freelance and Harvard Graphics are built-in. You don't need to buy a separate graphics package.

YES! Compatible with Lotus 1-2-3 files, macros, and publishing styles and with Excel .XLS files.

Find your spreadsheet information in a flash!

From everyday tasks to complex projects, Spreadsheet Notebooks are the easiest way to work with your spreadsheets. By incorporating multiple spreadsheet pages in a single file (one notebook can handle up to 256 spreadsheet pages), you can break any complex spreadsheet into easy-to-manage pieces. Assign meaningful names to your notebook tabs and finding information is as easy as flipping through a notebook.

Notebooks are the smart way to do 3-D spreadsheets! You can present data in flip-chart style and format pages in a group, like chapters. Because you navigate easily, it's simple to build multi-page models.



Notebooks

You may never open the manual

OBJECT INSPECTOR™ The Right Choice

Quattro Pro for Windows is the most usable spreadsheet ever. With Quattro Pro for Windows' object-oriented user interface, every action you take is easier and faster.

Object Inspector menus let you make one-step changes to any object on your screen with just a click of the *right* mouse button—no more searching through layers of pull-down menus.

Context-sensitive, customizable **SpeedBars**™ give you pushbutton access to your frequently used commands. **Drag and Drop** lets you move or copy data instantly with the mouse.

Built-in graphics rival standalone packages

Quattro Pro for Windows gives you extraordinarily powerful graphics tools *built-in*. You'll never have to learn a separate graphics package.

Get 35 2-D and 3-D graph types—with thousands of variations. Then enhance your graphs by adding text, lines, arrows, and built-in clip art.

Use the **Slide Show** and **Light Table** to create incredible electronic presentations. Arrange and rearrange slide shows in seconds and customize them with dazzling transition effects.

You can create 35mm slides and overheads, too. No other spreadsheet gives you all this presentation power.

*Quattro Pro for Windows and Spreadsheet Notebooks have patents pending.

Quattro Pro beats

Other spreadsheets don't compare

FEATURE	QPW	EXCEL 4.0	1-2-3/W R1.1	1-2-3 R2.4	1-2-3 R3.1
ORGANIZATION					
Spreadsheet Notebooks	Y	N	N	N	N
Nameable Tabs	Y	N	N	N	N
Group Formatting on Selected Pages	Y	Y	N	N	N
True 3-D Consolidation	Y	N	Y	N	Y
EASE OF USE					
Right Mouse Button Formatting	Y	Y	N	N	N
Object Inspectors	Y	N	N	N	N
Context-sensitive SpeedBars	Y	Y	Y	N	N
SpeedFill and SpeedFormat	Y	Y	Y*	N	N
Drag and Drop	Y	Y	N	N	N
GRAPHICS AND PRESENTATIONS					
3-D Graphs	Y	Y	N	N	N
Slide Show with Light Table	Y	N	N	N	N
Live Linked Graph Types and Formatting in Slide Shows	Y	N	N	N	N
DATABASE ACCESS					
Live View of Networked Database Tables	Y	N	N	N	N
Database Desktop	Y	N	N	N	N
CUSTOMIZATION					
Macro Buttons on Spreadsheet	Y	Y	N	N	N
Visual User Interface Builder	Y	N	N	N	N
COMPATIBILITY					
Reads Quattro Pro, Excel, 1-2-3 Files and Styles (including Allways & Impress)	Y	N	N	N	N
Runs Your QPro & 1-2-3 Macros†	Y	N	N	N	N
ANALYSIS					
Optimizer	Y	Y	Y	N	Y

*Requires add-in.

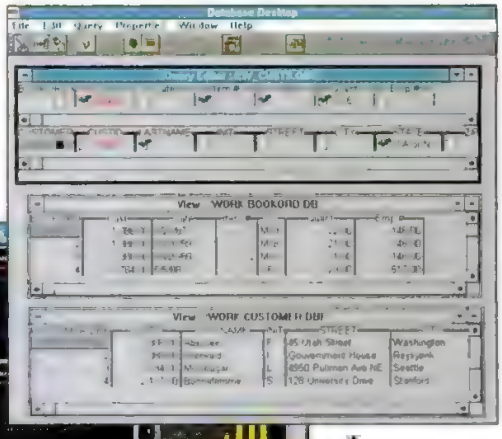
†Some 1-2-3 macros may require modification.

Outstanding 1-2-3 and Excel compatibility

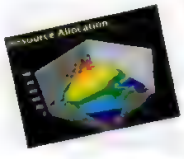
Quattro Pro for Windows is the next-generation Windows spreadsheet. It is the *only* spreadsheet that gives you both innovation *and* compatibility with Lotus 1-2-3, Excel, and Quattro Pro. Quattro Pro for Windows supports 1-2-3 files, macros, and publishing styles, including Allways, Impress, and WYSIWYG. It also supports Excel .XLS 3.0 and 4.0 files. What's more, Quattro Pro for Windows is much more compatible with 1-2-3 than Excel. For example, unlike Excel, Quattro Pro formulas, ranges, and command actions (like moving blocks) work as 1-2-3 users would expect.

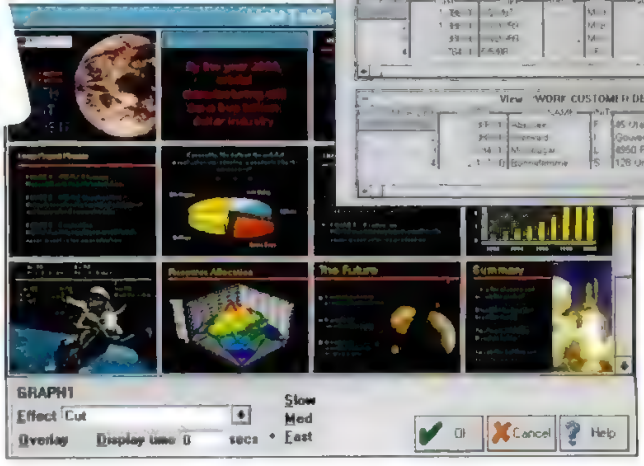
Fast database access to dBASE and Paradox

Only Quattro Pro for Windows gives you easy access to database information. Borland's unique Database Desktop™ lets you view, edit, and copy dBASE and Paradox tables *directly* from within Quattro Pro. And *only* Quattro Pro for



▲ *The Database Desktop: Only Borland makes access to dBASE and Paradox data this easy with QBE.*





Only Quattro Pro for Windows gives you a Light Table to arrange your electronic slide shows in seconds. ▶

1-2-3 and Excel!

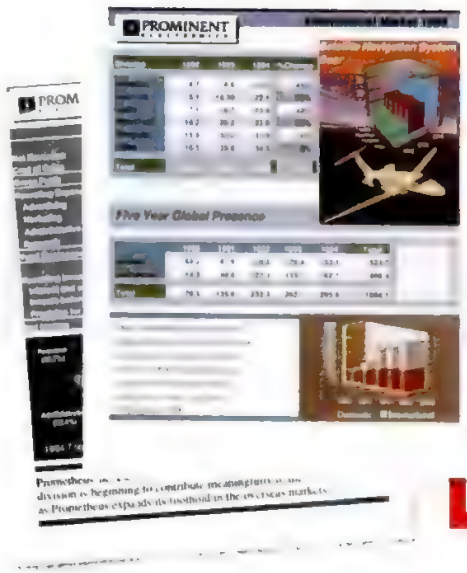
Windows has Query By Example, so you can ask questions about your data with point-and-click ease. Since it's from Borland, the database leader, you can count on it working right even in network environments.

Create custom applications in minutes

Because of its object-oriented design, *only* Quattro Pro for Windows makes it easy to customize your spreadsheet. All the tools are there for you to create your own custom dialog boxes, powerful time-saving macros, and SpeedBars.

Don't settle for second best

Get the spreadsheet from the company that J.D. Power and Associates ranked #1 (tied with WordPerfect) in Customer Satisfaction Among Business Users.* Get Borland's Quattro Pro for Windows today!



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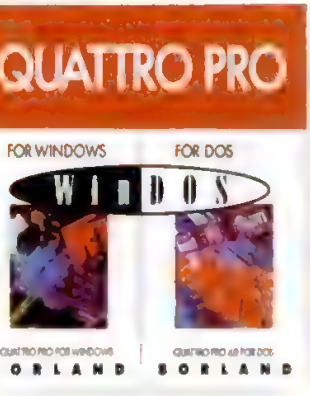
"Quattro Pro for Windows is [what] Lotus should have released, but didn't."
InfoWorld



"Quattro Pro 4.0 [is] the ultimate DOS spreadsheet."
PC Magazine

BORLAND

Software Craftsmanship

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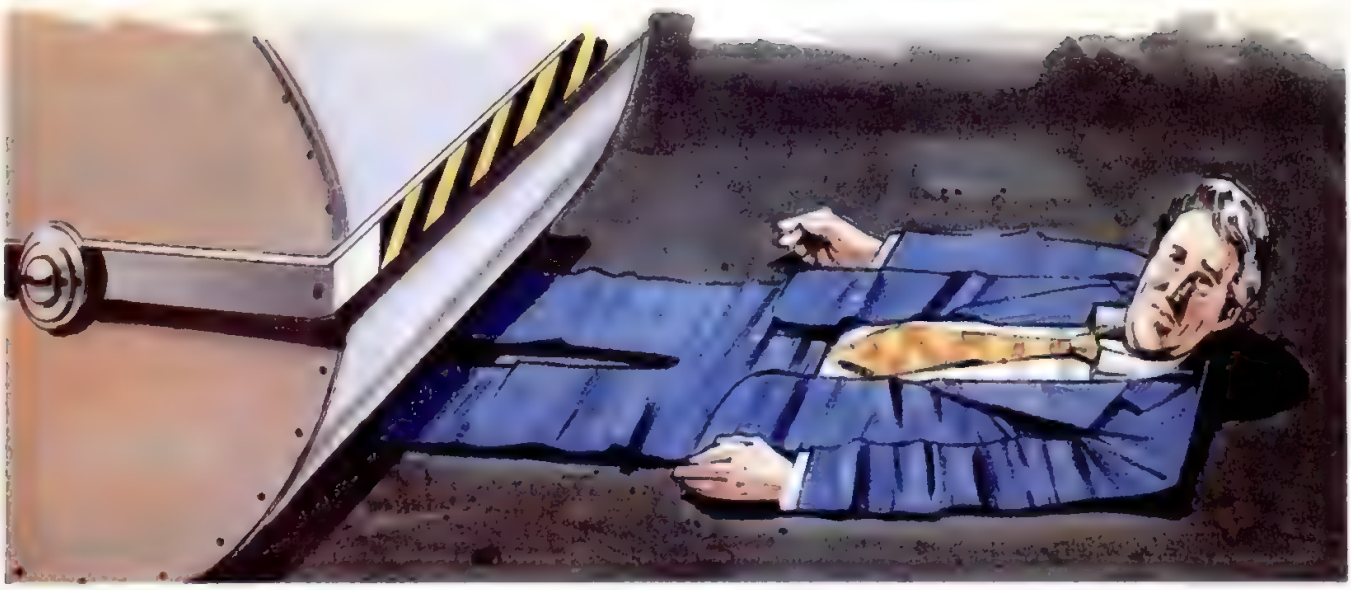

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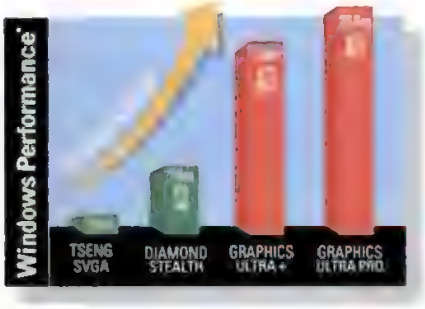
1024 x 768 / 256	■	■	■

Up to three times faster than competing S3 solutions and even local-bus products, our mach 32 graphics processor propel Windows to an amazing 25 million WINMARKS.*

mach 32



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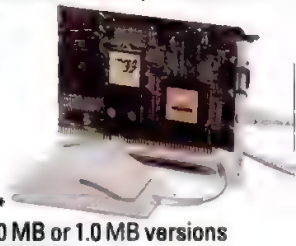

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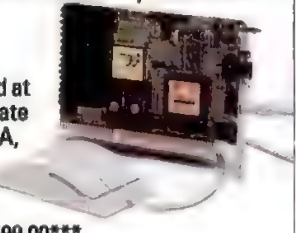

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REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Carol Levin

Adventures in Memory Land: Four Configuration Guides

BY BARRY SIMON

You can't be too rich or have too much RAM. But if you haven't a clue what to do with all your memory, then you need to get a grip on the HMAs and UMBs in the memory zoo. To help run today's memory-hungry applications, *The Microsoft Guide to Managing Memory with DOS 5,* by Dan Gookin, tells novices all they need to know in a slim 182 pages. He begins with memory principles and progresses to advanced trickery, such as moving the page frame to the E000 segment address. (If this tip sounds like Greek to you, rest assured that Gookin explains what it all means in clear English.)

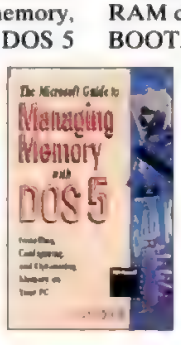
Other complex topics, such as the memory managers QEMM-386 and 386MAX, disk caches, RAM disks, and the basics of Windows memory management, are treated simply, with no discussion of the memory managers' advanced options.

If your setup is basic, and you just want to understand how memory works, what your PC does with it, and some of what DOS 5, QEMM, or 386MAX is doing, you can't go wrong with this readable introduction.

For the more adventuresome, John Goodman's 1,092-page *Memory Management for All of Us* tells all—from DPMI to VCPI, from DESQview to GeoWorks, from defraggers to boot sectors, and from Mark/Release to Swap Utilities. The discourses are clear, but the subject matter often rambles far beyond memory management. Predictably, DOS 5's task switcher is covered, but there are also descriptions of DOS shell programs and program launchers—which are so brief they're almost useless. Still, if you absorb all the information this book has to offer, you'll be a veritable PC guru.

Readers of *PC Magazine*'s Tutor column are already familiar with Jeff Prosise's crystal-clear discussions of system issues. You won't be disappointed in his book *PC Magazine DOS 5 Memory Management with Utilities,* a 227-page compendium of clearly written explanations and tips that clarify even the arcane. Prosise's expertise as a programmer is evident as he deals with issues such as the DOS API for UMB access, a topic that even Goodman skips.

Prosise has also written the ten utilities on the accompanying disk, including programs that produce memory reports, remove TSRs from memory, place the file tables in DOS 5 UMBs, and save and restore CMOS configurations. These are well-made programs, of interest to those who stick with DOS 5 for memory management. They're of less interest to those who use third-party memory managers and have a good collection of utilities, since most of their functionality is duplicated in one of these two places.



Prosise's crisp writing and excellent utilities make this the book of choice for DOS 5 users.

Memory Management and Multitasking Beyond 640K, by Lenny Bailes and John Mueller, is notable for its extensive discussion of OS/2, DESQview, and Windows. Each presentation in this 424-page guide is filled with tips and optimization tricks. There are more than 30 pages that explain options in Window's WIN.INI and SYSTEM.INI files, and the OS/2 discussion has many CONFIG.SYS parameters. There are seven pages of undocumented DESQview switches.

On the memory management side, the book offers a wealth of detail on QEMM, 386MAX, and NetRoom, including technical support notes from Quarterdeck and Helix. The authors also provide tips for working with popular applications, including DR DOS. The bundled disk includes Mark/Release, ASQ (a memory/system reporter from Qualitas), a RAM disk, a print spooler, and BOOT.SYS (a shareware program that juggles multiple CONFIG.SYS and AUTOEXEC.BAT pairs).

On some technical points, though, the book is sloppy. It claims that Windows 3.1 has a DPMI 1.0-compatible server, when in fact the server is only 0.9-compatible. And Bailes and Mueller assert that DPMI works exclusively with Windows, ignoring the DPMI support in the version of 386MAX reviewed in their book.

To sum up: If you're using a third-party memory manager and want something less voluminous than Goodman's book, Bailes and Mueller is your best choice. Go with Prosise or Gookin if you want a quick, painless introduction. And check out Goodman for a comprehensive course.

• *The Microsoft Guide to Managing Memory with DOS 5,* by Dan Gookin, $14.95. Microsoft Press, One Microsoft Way, Redmond, WA 98052-6399; 800-677-7377. ISBN: 1-55615-381-3.
Circle 456 on reader service card

• *Memory Management for All of Us,* by John Goodman, $29.95. Sams, 11711 N. College Ave., Carmel, IN 46032; 800-428-5331. ISBN: 0-672-27366-7.
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• *PC Magazine DOS 5 Memory Management with Utilities,* by Jeff Prosise, $34.95 (with disk). ZD Press, 5903 Christie Ave., Emeryville, CA 94608; 800-688-0448. ISBN: 1-56276-050-5.
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• *Memory Management and Multitasking Beyond 640K,* by Lenny Bailes and John Mueller, $29.95 (with disk). Windcrest/McGraw-Hill, Blue Ridge Summit, PA 17294-0850; 800-822-8158. ISBN: 0-8306-3456-8.
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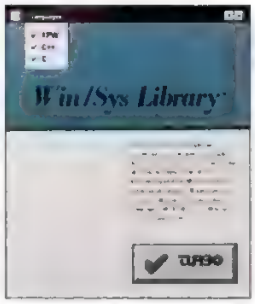
Win/Sys Library: Myriad Low-Level Functions for Windows Programming

BY NEIL J. RUBENKING

Win/Sys Library (WSL) from TurboPower Software is an amazing collection of low-level routines and data structures that enhance Windows programs at the functional level. Not just another user-interface library, WSL is the Windows equivalent of the system-level portions of TurboPower's highly acclaimed Object Professional. International date and time manipulation, 64MB data arrays, DPMI access to real-mode memory—WSL makes these features and many more available to Pascal, C, and C++ programmers.



The bulk of the WSL functions reside in two DLLs (dynamic link libraries), and WSL provides DLL interface modules for all supported language compilers. DLLs are language-independent, so it's likely that even nonsupported compilers could access the WSL functions. One thing you *won't* see much in WSL is object-oriented programming (OOP). Only a few language-specific modules use OOP at all, because WSL has to support multiple compilers with different implementations of objects.

WSL displays a tiny bias toward Pascal. The dynamic link libraries are written in Turbo Pascal for Windows (TPW); consequently, only TPW users have the option of binding the WSL functions *directly* into their programs instead of calling them via the DLLs. However, C and C++ programmers can use essentially all of WSL's features.

The documentation is thorough—over 500 pages of small print. Also, C and Pascal example programs supplied on-disk demonstrate just about every facet of WSL, for those who learn better by looking at code.

THE COMPONENTS OF WSL

WSL is divided into four major sections: data manipulation, container classes, DOS access, and advanced system-level Windows routines. The *data manipulation* area starts with a wide array of string-handling functions. Besides the expected string functions, there are gems like Soundex, parsing routines, and a Boyer-Moore text search. Other routines perform math and text conversion date and time structures.

The most impressive item in the data-manipulation realm is the sorting module. Using a nonrecursive QuickSort, it sorts over 2 *billion* elements of any data type, as long as they fit on the Windows global heap. Example programs demonstrate methods for displaying progress, yielding to other processes, and allowing the user to abort a long sort.

Language-specific files provide OOP implementations of linked lists, but the rest of WSL's *container classes* are not OOP-based. Rather, they use pseudo-objects that encapsulate data structures and related functions but don't implement inheritance or polymorphism. These include bit sets tracking over 100 million bits, binary tree structures, hashed string dictionaries, and FIFO (first in, first out) queues. The large array data structure defines a one- or two-dimensional array with a maximum size of 64 *megabytes*. WSL incorporates routines to store these huge arrays to disk. All of the supported compilers provide *DOS access*, but WSL goes further, especially in the area of file and disk drive handling. One routine makes a copy of any file; another identifies a disk drive as a floppy drive, hard drive, Bernoulli drive, SUBST drive, RAM disk, or network drive! For TPW users only, WSL has random-access routines for text files—very handy for writing unlimited-size file browsers. Finally, a set of BIOS-based timer functions makes it easy to set up countdown timers or measure elapsed time.

Any program that works with real-mode memory or real-mode TSRs is liable to need the DPMI functions in the *advanced system-level Windows routines*. With these routines, a program can safely access conventional memory using real-mode addresses, call real-mode interrupts, and even handle interrupts in protected mode. The error recovery module lets programs gracefully trap and recover from errors of various types, up to and including General Protection Faults. Finally, compiler-specific heap-checking modules help track down errors in dynamic memory allocation.

Besides the small example programs that demonstrate particular WSL functions, there are a number of full-fledged utilities, again complete with source code. Perhaps the most amazing of these is WSHELP. If you follow a few simple rules for commenting your TPW programs, WSHELP will read the source code and generate an RTF (Rich Text Format) help file suitable for processing by the Windows Help Compiler. Instant documentation!

A pair of bonus modules used by the sample programs will delight any Windows programmer. One defines a list-box control that can hold over 2 billion items (the standard list box holds fewer than 6,000); the other is a hex dump display window that displays any chunk of memory. You can learn a lot by reading source code for this.

Win/Sys Library is simply too big to grasp all at once. To avoid reinventing the wheel, memorize the *types* of functions WSL includes, and check the documentation before you write a new function. Chances are, that function is already present in WSL!

• *Win/Sys Library*, List Price: *$149*. Requires: *A PC capable of running Microsoft Windows 3.x in Standard or Enhanced mode; Windows 3.0 or later (3.1 recommended), DOS 3.1 or later (some routines require a later version); Turbo Pascal for Windows 1.0 or later, Turbo C++ for Windows 3.0 or later, Borland C++ 3.0 or later, or Microsoft C++ 7.0; 400K to 3MB of disk space. TurboPower Software, P.O. Box 49009, Colorado Springs, CO 80949-9009; 719-260-9136 (voice), 800-333-4160 (orders).*

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Introducing

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The top-of-the-line ThinkPad 700C sports a screaming 486 SLC™ 25 MHz processor. But it's built for comfort too. There's a surprisingly roomy interior, with a full-size, ergonomically designed keyboard. And a screen that literally bends over backwards.

Strategically placed on the keyboard is a little red spot called the TrackPoint II.™ It does what a mouse would do with a few million more years of evolution. Nothing dangles; it's part of the soul of the machine. You can operate it with one fingertip. And it lets you think on any terrain, even one without any flat surfaces.

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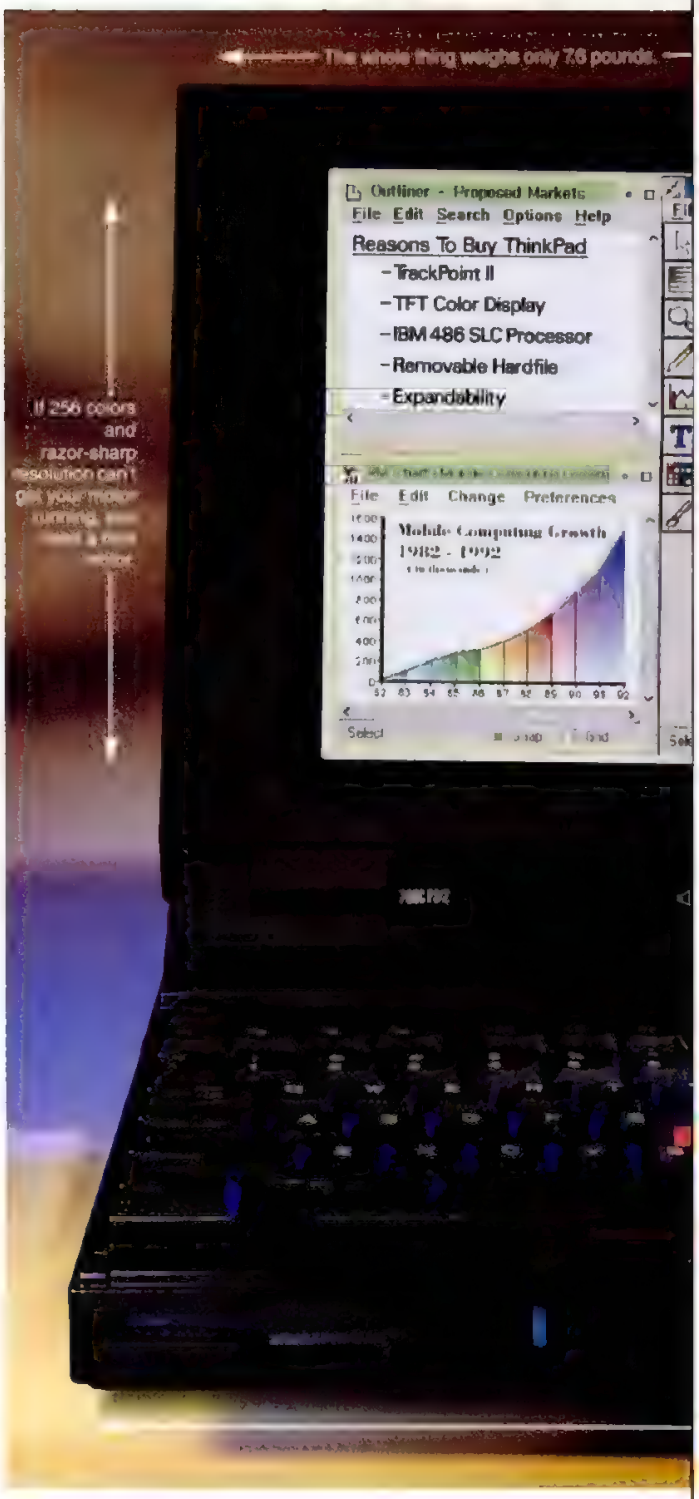

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CIRCLE 315 ON READER SERVICE CARD

Michael J. Miller

Break Up Microsoft?

Break up Microsoft? The words sound unbelieveable, almost blasphemous. But as I write this, there are news reports suggesting that an FTC panel is about to recommend legal action aimed at just that result. More surprising, I'm hearing more people in the industry advocate Microsoft's breakup into a systems software company and an applications company.

Most of the controversy hinges on the question of whether Microsoft has an unfair advantage because it controls both the operating system (DOS and Windows) and the lion's share of application sales under Windows. Does Microsoft have an advantage? Absolutely. Is it unfair? There's the rub.

You've probably heard talk lately about the undocumented calls in Windows and the disclosure that Excel and Word for Windows use some of these calls. The furor began with Andrew Schulman's Lab Notes on the subject (*PC Magazine*, January 28, 1992) and continued with the August publication of *Undocumented Windows*, by Schulman, David Maxey, and Matt Pietrek. Microsoft claims these calls are obsolete or documented, and besides, everyone uses them. That's probably true, but when Microsoft is out there selling more Windows applications than anyone else, you can understand why competitors are wary of any potentially unfair advantage.

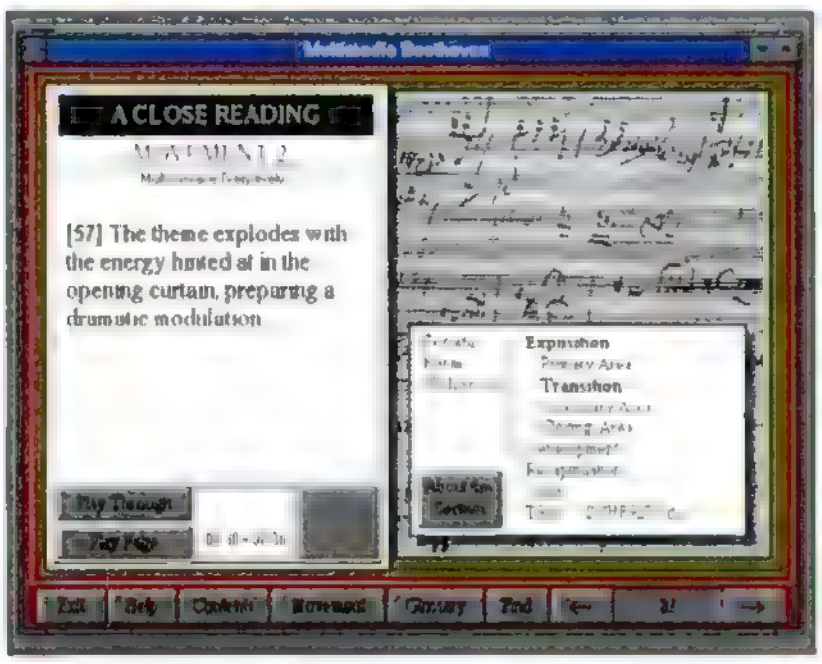
Undocumented calls are the not real issue, however. Every application and operating system has a few of them. After all, it was undocumented calls in DOS that allowed for the development of TSR programs such as Borland's SideKick. The real question is whether Microsoft specifically put features in Windows for its own applications (or even for other developers' applications) without making them widely available, or if it designed standards in such a way that its own applications gained an advantage.

From the outside, it seems as though system standards aren't quite finished until Microsoft applications have made use of them. The OLE (Object Linking and Embedding) standard wasn't released until after OLE was used in PowerPoint and, later, Excel. In fact, Microsoft says OLE was developed by its applications group, not its systems programming group.

More recently, Microsoft has been talking up its Open Process program, which lets third-party developers comment on and make additions to API (application programming interface) specifications before they become final. This process has let developers comment on upcoming standards such as OLE 2.0, the messaging API (MAPI), and Open Database Connectivity (ODBC). Yet MAPI was first supported in Microsoft's Windows for Workgroups. You can expect Microsoft's upcoming Access to be the first to support ODBC. And Microsoft applications will undoubtedly be among the first to support the new multimedia APIs.

The question is how much is due to Microsoft's having inside information and how much to its making an early commitment to each of these standards?

Why is Microsoft successful in selling Windows applications? Because the market let it happen, and because Microsoft recognized the Windows market earlier than competitors. I recall Microsoft promoting Windows even as it created its own OS/2 applications. Many competitors turned down Windows completely or promised Windows versions that were very late to show up.



By controlling both operating systems and applications, Microsoft does have an advantage. But is it unfair?

GIVE US GOOD APPLICATIONS

The real strength Microsoft has in selling Windows applications is . . . great Windows applications. Excel and Word for Windows are top-flight applications that have sold well because customers are happy with them. That's the way the market is supposed to work. It also opens the door for other

Michael J. Miller

application vendors to compete with better applications: I'm writing this column with Lotus Ami Pro 3.0, which has pulled ahead in the word processing features war; Borland's Quattro Pro for Windows is the most advanced, most forward-looking Windows spreadsheet to date; I find Lotus's Freelance Graphics much easier to use than Microsoft's PowerPoint; and Intuit's Quicken for Windows has proven to be an able competitor to Microsoft Money.

The key to selling applications continues to be developing state-of-the-art products, staying ahead of the competition, then letting customers know. It seems to be working in the Windows market just as it's worked in other markets.

Do we really want the government to get involved and oversee the software business, known for its entrepreneurial streak and fast pace? If Microsoft is judged to be competing unfairly, does the judgment end there? What about industry conferences where leaders of competitive firms discuss strategy? What about all the standards committees? None of this is completely open—you'd have anarchy instead of the usual constructive chaos. I'm more than a little afraid that government interference would just slap on new rules and bureaucracies that would only slow the business down.

But at the rate Microsoft applications are selling, are we in danger of Microsoft becoming a monopoly? It's crucial that the software developers, the media, and the customers keep this market competitive.

One radical solution would be for Microsoft's competitors to promote an operating system such as IBM's OS/2. Imagine how different the market would be if Borland, Computer Associates, Corel, Lotus, Micrografx, and WordPerfect decided really to invest in their OS/2 applications. Continuing competition, from OS/2, Unix, or NextStep, is essential to keeping the industry moving at its current pace. Competition makes everyone's products better. Look at what DR DOS did to Microsoft's MS-DOS efforts and what Quattro Pro and Excel have done to Lotus's spreadsheets.

A less radical move would be for the major software vendors to define more of the standards that work with Windows. All sorts of options are possible: from Borland's database formats, to its "Object Inspector" interface, to Lotus's VIM message standard and its TOOLS approach for linking in objects, to HP's New Wave object-oriented front end for Windows. The playing field would be more level if all the vendors worked together and supported each other's standards efforts. The emerging TWAIN standard in the graphics world is one example of such efforts.

Microsoft also needs to make new APIs and system environments available to third-party developers as soon as possible. Those of us in the press need to be vigilant on this matter, and customers should complain loudly about any attempts to make systems standards less than completely open.

Customers are, after all, the most important component. We all have to keep looking for better solutions and expect constant innovation—from Microsoft, its competitors, and even from emerging companies. This means selecting software because it's the best of breed, not because of the developer's name. After all, no one has ever seen a perfect program. As long as we keep looking for the better mousetrap and making sure the field is open and fair to new mousetrap developers, it's unlikely that Microsoft or anyone else will ever be able to get and sustain a monopoly. □

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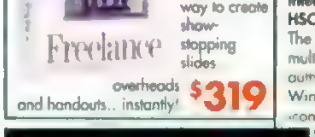

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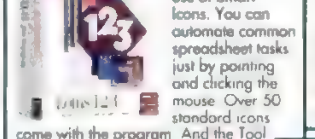

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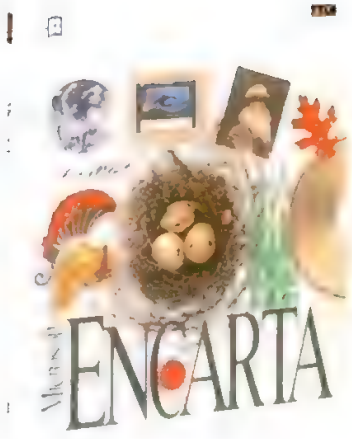

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Bill Machrone

Through a Glass, Darkly

From where you sit, you can probably see shelves groaning with *PC Magazines,* all neatly lined up by date. You don't need a straightedge to see the sagging belly in the middle of the shelf. You're still wondering when Fenton is going to return the printer issue. Hah. You'll probably get next year's first. Or perhaps your *PC Mags* are piled in order of interest, where the ones you refer to most often make their way to the top of the stack, like the plumpest blueberries at the fruit and vegetable stand. Every once in a while the stack slides over, neatly arranging itself into a Brobdingnagian imitation of a card shark's fan out. There's gotta be a better way, you say to yourself. Why can't we deliver *PC Magazine* electronically? Heck, the savings in postage alone would justify it, never mind the paper.

Readers have been asking that question as long as there have been readers of *PC Magazine.* After all, these people all have computers; what could be more natural than having the magazine delivered on-disk?

You know that *PC Mag* has never been small enough to fit on floppy disks—even several of them, with the most advanced compression techniques. Well then, what about CD-ROM? Six hundred megabytes' worth is surely enough. It surely is, but for one small problem: You probably don't have a CD-ROM drive on your system. If you do have one at the office, you probably don't have one at home, or vice versa. You definitely don't have one on your laptop. We have a classic chicken-and-egg problem here, because if we offered our publications on CD-ROM it would be a great incentive for more people to purchase CD-ROMs.

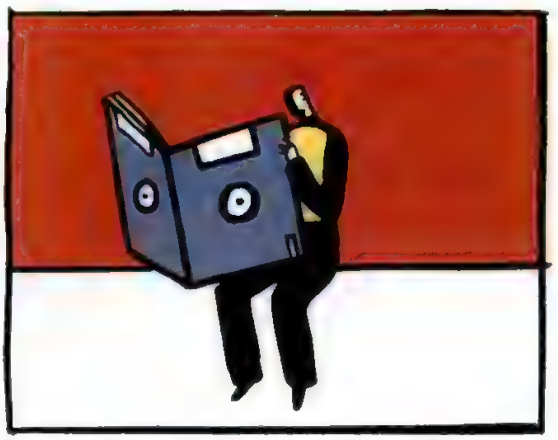
Of course, *PC Magazine* is available on CD-ROM as part of Computer Select, our popular product with the full text of all our publications and many others. But no one reads *PC Magazine* from Computer Select. They use Computer Select as it was intended, as a comprehensive research tool. Computer Select contains only text, programs, and some spreadsheets, no digitized photographs or other graphics elements that make up a magazine.

Let's assume for the sake of argument that CD-ROMs are ubiquitous. Now we need an interface. The last of you DOS holdouts would have to cave in, get a mouse, and use a graphical user interface, because a magazine is at its heart a graphical device.

Let's also assume that we've solved all the problems of access speed and retrieval and have come up with some clever ways of linking text and graphics. The graphical resolution of this printed page is upwards of 1,200 dots per inch. Your screen has a resolution of perhaps 75 dpi. A lot of information gets lost on the way down. No screen currently exists that can match the information density of this page. Do you have 24-bit or 32-bit color? If not, the photos are going to take on that odd, posterized look. If you do, you'd better have a wickedly fast machine, because it takes time to get all those bits off the CD and on to the screen. Want to save a page in a literature file or pass it along to a coworker? You'll have to print it out first or do some kind of cut-and-paste operation and send it over the network.

Of course we haven't solved many, or perhaps any, of the user interface problems. A magazine is a magnificent random access device. It lends itself to the way people work, in size, format, and information density. The user interface is hundreds of years old with a history dating back to the earliest papyrus scrolls, the illuminated manuscripts of the Middle Ages, and reaching fruition in the post-Gutenberg centuries with the introduction of color, graphics, and modern composition systems.

There are dozens or hundreds of subliminal cues on each page that direct your eye and your in-



What good is a CD-ROM version of this magazine if you can't read it backwards?

Illustration by Alison Seiffer

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Advanced printer-sharing technology. Our ***ServerJet*** products give up to 12 users a direct line to the printer. ***ServerJet*** also lets users switch back and forth between two printers – without leaving their chairs. People won't be lined up, disks in hand, waiting to use the PC connected to the printer. Each user can simultaneously send *their* print job, *their* way, thanks to ***ServerJet*** buffer memory (up to 4MB).

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terest. A tiny square at the bottom of a column of type tells you that the article ends there and that you can read it in the next minute or so. A key word or phrase piques your interest and causes you to read the entire article. A caption under a chart works synergistically with what you've just read and increases your understanding.

Then you get into good old human weirdness. One tenth of the people in the world read magazines backwards. In magazines that "jump" (this one doesn't), they store up their memories and impressions of the ends of various articles, then mentally put them together with the beginnings. In magazines that don't jump, where one article ends before the next begins, they still ignore the best efforts of editors and art directors to build a logical, attractive, and inviting sequence and flow. Most backwards-readers aren't even aware that they do so. Others flip pages, looking for articles of interest, then go back and read the whole thing cover to cover. How will a computerized magazine address these idiosyncrasies?

Once you're done reading a magazine, its usefulness decays rapidly and that nice, neat shelfful or that haphazard pile are equally unhelpful when it comes to finding something that you know you've read but you can't remember where. CD-ROMs and on-line services (our text is also available on ZiffNet) are the answer. Response is near-instantaneous, and you will likely get more useful information than you had expected as citations come up from other back issues or titles. Suddenly you have not only the article you were looking for, but a historical perspective and perhaps even contrasting views. You can read all the text on-line, but your best bet is to go back to the issues of the magazine where you see the information the way the editors intended it: with graphics, typography, color, and sequence.

The day will certainly come when we have gorgeous, high-resolution displays with refresh rates and access times that let us see data at the same rate as we flip pages. We'll probably have tactile interfaces, so we can thumb through the electronic pages. Maybe the whole thing will weigh a couple of pounds and fit in your briefcase. Maybe the advertisers will even find a way to ensure that you don't skip over the ads.

Until then, you can expect your mail carrier to be groaning under the weight of many more issues of your favorite computer magazine. □

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And even though it's small, the ZEOS Pocket PC carries a *full suite of industry standard software* already loaded and ready to go! You get Microsoft DOS 5.0 system files with built-in file transfer and Microsoft Works 2.0 with word processing, spreadsheet, database and communications programs. Plus, you get a personal organizer which includes a calendar/planner, "to do" list, business card file, information retrieval (for country codes, converting measurements and currency) and more. It's everything you need to manage your life!

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We asked our customers what it is they want in the perfect notebook. The first thing they told us is that most notebooks look like a cigar box with a lid. They told us they wanted not only good looks, but things like great power *and* great battery life. Lightweight too, like five pounds and change. And the keyboard should be effortless to use. The entire product had to be extremely durable. And that was just for starters.

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2MB, 60MB Only $1895!

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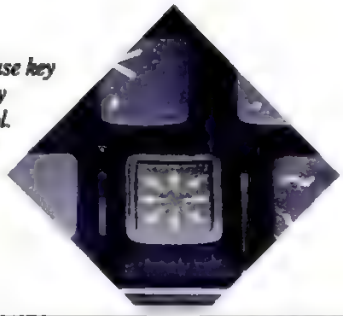

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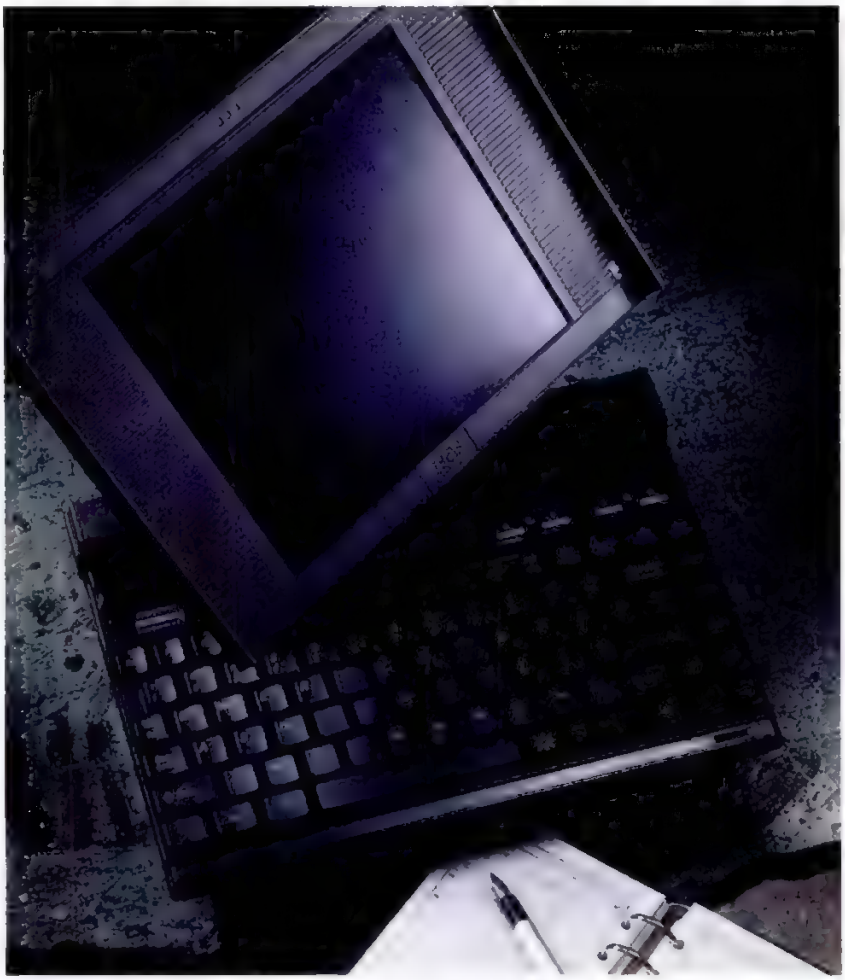

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Now. A color notebook that's one of the lightest yet! The new ZEOS Color Notebook packs it all in at only 6.7 lbs. —including the battery.

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CIRCLE 038 ON READER SERVICE CARD

John C. Dvorak

I Can't Hear You

What is it with the PC and sound, anyway? The Amiga has had stereo CD-quality sound since its introduction. The Macintosh has had 16-bit sound since 1984. But as we approach 1993, the PC still has this gosh-awful little speaker and no real sound to speak of.

While many vendors brag about the upcoming multimedia revolution, they'd better wake up and smell the toast. It isn't going to happen if there isn't standard sound on every PC being made today. Sure, you can add a Sound Blaster or an AdLib card or the new Microsoft Sound System, but this hardly constitutes a standard. IBM, for example, uses the Roland gear while everyone else uses something different.

I've been fascinated for a while now by the PC's dismal sound capability and have found plenty of reasons why we'll never see standardized sound on the PC.

First, the rigid mindset of PC makers associates sound only with games, and the PC was never supposed to be a game machine. So while the Covox Speech Thing or the Disney Sound Source add new dimensions to games, they also help to slow the development of standardized sound.

Furthermore, the PC has become the dirt-cheap computer that anyone can afford. Steve Jobs once called the Mac the computer "for the rest of us," meaning it wasn't bound by the thinking and conventions of the big corporations—a.k.a. IBM. Today, PC clones are the true "for the rest of us" computers. Who, ten years ago, would have figured that $2,500 could buy a PC with nearly 100 MIPS of computing power?

To achieve that low price, sacrifices have to be made. The first thing to go is sound—the true stepchild of the PC. Just as it's about to be incorporated, the price pressure makes it expendable.

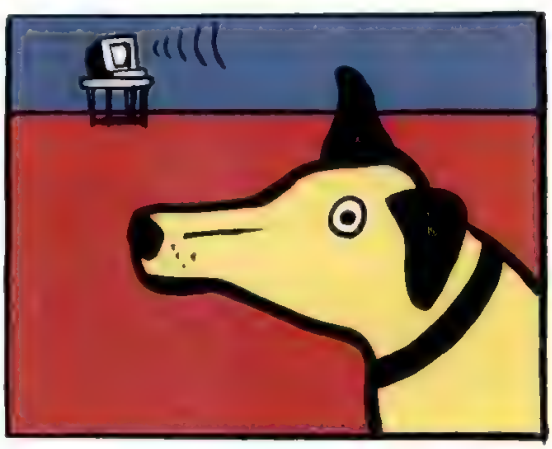
Sound can no longer be ignored. Networked voice mail and computers that talk *and* listen are waves of the future. But the PC industry seems to be ignoring these trends. Voice recognition software is now being used by banks to help you retrieve credit card information. You'd think that PCs could at least keep up with the dullards in banking, wouldn't you? So where's the sound?

I suppose you could just plug headphones into a CD-ROM drive or run the sound output to an amplifier, but the best solution is to build sound right into the machine.

The key is the development of a one-chip solution as elegant as the one-chip IDE controller or the Artisoft Ethernet chip. It's ridiculous, but the addition of an Ethernet port will be commonplace before standardized sound. An Ethernet port will, of course, sell more computers than sound. So we get the Ethernet port, and we're still stuck with the dinky speaker and no sound.

I'd like to list a bunch of ways sound can be standardized on the PC once and for all. But it won't happen unless users begin to demand sound. Only a few people will spend the hundreds of dollars *extra* that is currently required to bring a PC up to multimedia standards. The expensive Microsoft solution is surely no help.

The key to all this is user demand. In fact, forget all the wave of the future nonsense. The PC user is something of a mute. Stuck in a pathetic cubicle, he or she doesn't need or want sound. We can't use voice recognition where the machine may respond to the commands of the guy in the next cubicle, and we don't need to have everyone in the office hear our voice mail. Today's dreary offices have prevented sound from becoming standard on the PC. So, as far as I can tell there will be no sound on the PC unless the entire business scene changes its style. I see no evidence that this will happen. So forget sound. Forget multimedia. It won't happen here. □



Sound is the PC's true stepchild. What we need is a one-chip solution, and users who demand it.

Illustration by Alison Seiffer

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The Model 97 combines NEC's microfine toner and Sharp Edge Technology to provide superior print quality. It also includes a built-in envelope feeder and uses a single-piece, eight-thousand-page consumable cartridge.

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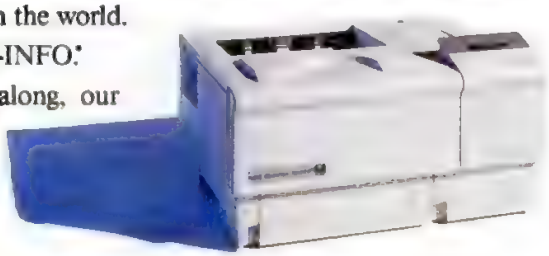

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CIRCLE 217 ON READER SERVICE CARD

John C. Dvorak

Inside Track

The most talked about chip on the street is the new **DEC Alpha chip** which will **pump out 150-200 MIPS** in RISC performance when it's finally incorporated into a workstation. The company intends to utilize the **EISA bus**, believe it or not, for this system. They also intend to run Windows NT as their primary operating system. You have to wonder about this decision, especially now that Microsoft has delayed Windows NT until mid-1993.

Rumors from Redmond indicate that NT is far from ready. Microsoft is fully aware of the negativism that followed OS/2 1.0, and if NT is a flop in any way, it could derail all strategies.

There were very few industry observers who believed Microsoft's continuing promises of a late 1992 release of Window NT. "It's on schedule for 1992 release," they'd say over and over and over. This was despite the fact that backward compatibility and DOS support for the pre-beta were non-existent. Besides that, **why would Microsoft want to rush this product** to market while it's cleaning up with Windows 3.1? It made no sense that NT would ship in 1992. Furthermore, anyone who has had experience with Microsoft and its **overly optimistic** ship dates for everything from DOS 5 to any version of Windows knows that the company is always wrong.

Rumors from Redmond indicate that NT is far from ready, and Microsoft is fully aware of the marketing fiasco and negativism that followed the release of OS/2 1.0. It's taken years to get people back on track for that operating system. If NT was released and was **a flop** in any way, it would prove a boon to OS/2 2.0 and perhaps **derail** all of Microsoft's strategies. So why would the company rush the product out under those circumstances? They won't. I expect to see Windows NT next August.

Mission Impossible Dept.: As many of you know there is a 15-foot limit to the parallel cable used on the parallel port of the PC. Beyond 15 feet, the signal starts to fall apart, and without **boosters** and other expensive add-ons **you simply can't print**. This is the real reason that Apple adopted a network connection to link to its LaserWriter. Networks have been the solution to this problem. Well, at least until now. Autotime Corp. (6605 SW Macadam, Portland, OR 97201, phone 503-452-8577) has developed a patented technology that allows you to **use a parallel cable of over 200 feet!** In fact, they sell a 200- foot cable for $239 as well as a slew of smaller cable lengths. There is a special circuit in the cable connector that reprocesses the signal without boosting or mere amplification. Very nice. Give them a call. The only drawback is that it can't work bidirectionally.

Kodak and the Future Dept.: If you haven't noticed, Kodak has been pushing its new photo CD technology like there's no tomorrow. In fact, there may be **no tomorrow** for film technology, so Kodak has the right idea. But perhaps the wrong time! Unfortunately, photo CD is a concept based on marketing myopia. The idea, if you don't already know, is to take a roll of film and move the images onto a CD-ROM or CD-I disk. Typically, four rolls of film go onto a disk. There are a number of **drawbacks** to this scheme.

The first drawback is that it's going to cost about **$25 per roll of film** to do this. Since most people taking pictures are rank amateurs who should toss out 99 pictures out of 100, this seems rather steep. Heck, even if you're an expert photographer this is steep! Anyway, the other **major drawback** is that few people own CD-ROM drives, and, as far as I can tell, nobody owns a CD-I player. I've only seen demonstrations of this technology. I can't even get one. Maybe the researchers at Kodak should reconsider their data.

Well one group that adores the photo CD concept are the professional photographers and others who can charge real money for their services. **Corel and Micrografx** are both selling the photo editing concept whereby you can take electronic photos and edit them fiendishly. The idea is good, if you can afford it.

Recently Kodak has gone **a step further** and introduced a writeable photo CD machine. It's essentially a WORM (write once, read many) drive that **creates a CD-ROM disk.** This baby is $10,000. Personally, I'll wait for the $400 Japanese version.

Read My Clips! When it comes to legal software, a leading company is Berkeley's Nolo Press. They have an outstanding newspaper called Nolo News, which highlights **interesting** legal stories and **cheap solutions** to expensive problems. It costs $12 for 2 years (Nolo Press 950 Parker St., Berkeley, CA 94710, phone 510-549-1976). Most people subscribe because the back page highlights the latest in **lawyer jokes.** "Did you hear that the Post Office had to recall its series of stamps depicting famous lawyers? People didn't know which side to spit on!" Yoikes! If you like that kind of material (and serious legal articles of interest to laymen), you'll love Nolo News. Highly recommended.

Final Notes Dept. I want to congratulate **Compaq** for its decision to go into Japan with el cheapo machines to **blow out** NEC and the others dominating the Japanese computer scene. I do have some advice for Compaq: KANJI!! □

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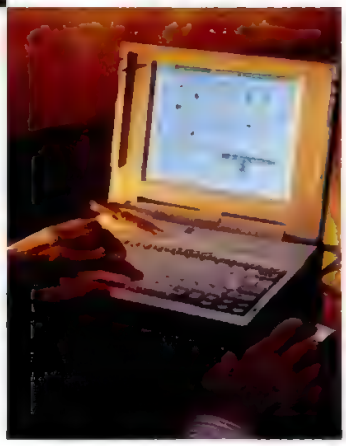

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CIRCLE 034 ON READER SERVICE CARD

Jim Seymour

Inside the Anti-OS/2 Conspiracy

How come you guys keep giving OS/2 such a bum rap? You're always writing about Windows, but I hardly ever see anything in your magazine about OS/2—and when I do, you only talk about the picky little things."

I've heard that complaint a hundred times now. With the release of OS/2 2.0, the Windows 3.1 versus OS/2 contest got hot, and not only in the ad pages of this magazine. The editorial staffers here endlessly argue about the two operating environments, often in print.

And, as readers like to point out, OS/2 seems almost always to get the worst of it. There is, some of them tell me, clearly a conspiracy against OS/2 in the computer press.

That's nonsense, and I'll tell you why. Let's take a little tour inside The Great Anti-OS/2 Conspiracy.

First, full-disclosure time: I like Windows a lot better than I like OS/2. I've used both, but for my daily work I return again and again to Windows 3.1 because it's a more reliable and practical operating environment. It's far from perfect, but in a matchup against OS/2, Windows wins on merit.

So of course I'm biased. (Columnists are *always* biased. At our best, we write from a kind of informed, objective subjectivity, from a consistent perspective, and with a profound fickleness. Show me something materially better and I'll change my tune in an instant.)

Here's the core of the problem: No one buys a PC to run an operating system; people buy PCs to run applications. Sure, readers want to hear what we think about new operating systems, but they want even more to hear what we think of new applications—especially the dazzling new applications that drive a decision to stay with one operating system or go through the pain of changing to another.

Today, in PC software, that means Windows 3.1 applications. Every single dazzling PC program I can think of right now is a Windows app.

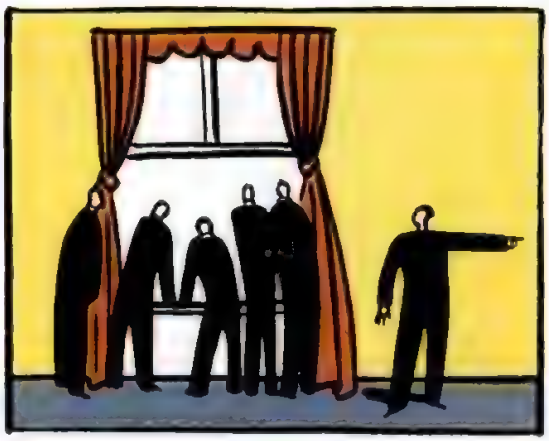
Sure, there are lots of great DOS applications, backbones of the PC revolution, used every day by 50 million people around the world. But they're not *dazzling*. And they're not where the PC software market is headed.

In the review process, Windows often comes off looking a lot better than it really is. When we rave about Excel 4.0 or Quattro Pro for Windows, Windows gets mentioned, and it basks in the reflected glow of these hot applications.

It doesn't matter that Windows still has holes you could drive a truck through, still locks up with General Protection Faults too often, still has huge and apparently unsolvable problems with fonts, and on and on.

On the other hand, when we write about an operating system itself—especially one without many good applications—we probably tend to overstate its faults, because *sans* applications, we're forced to peek into every little dark corner of the OS. And every operating system I know has some dark and scary corners.

This kind of apparent unfairness to PC operating systems isn't new. Every PC OS has benefited enormously from the attention that has been paid to the hotshot applications that are running atop it.



There's no conspiracy: The operating system with the most dazzling applications wins every time.

When we raved about the first release of Lotus 1-2-3, which ran only under PC-DOS, we helped sink the PC's other operating systems, the UCSD p-System, and Digital Research's CP/M. No matter that both were stinkers; the operating systems failed because they were *ignored*. None of the interesting early PC applications ran on the p-System or CP/M, so both were left out in the cold.

Even IBM couldn't change the fate of either OS: Though PC-DOS was supposed to be the lead operating system for its new PCs, IBM clearly in-

Illustration by Alison Seiffer

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*PrintDirector Gold Turbo printed nearly five times faster than Novell Lite, almost 2 1/2 times faster than ASP Port Authority, about twice as fast as ESI Share Spool and Buffalo SLmkII, and 40% faster than Lantastic. *Based on printing an output file created with Harvard Graphics. Total time for three PCs to print concurrently to two printers.*

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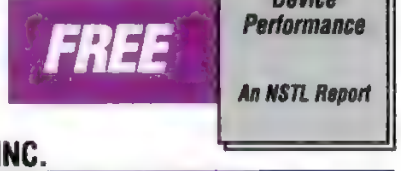

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CIRCLE 002 ON READER SERVICE CARD

Jim Seymour

tended the PC to be a three-OS platform. You could buy CP/M and the p-System, and the few applications for them, from IBM itself and from many early PC dealers. While IBM wanted PC-DOS on top, it wanted the others to succeed too. But they didn't because *hot apps draw the ink.*

And ink draws buyers.

Now history is repeating itself, in a sense, to OS/2's detriment. And again, even IBM can't change that. The difference, this time, is that the operating system IBM wants to win the contest doesn't have the hot apps.

Indeed, it's hard to think of a really good commercial, shrink-wrapped OS/2 2.0 application. Sure, there were plenty of commercial programs for OS/2, version 1.*x*, (though maybe not quite as many as IBM claimed in its infamous lists of available OS/2 applications). But very few of those programs were good ones.

Aldus's early OS/2 version of PageMaker was an exception. PageMaker's speed showed the promise of multiple threads of execution—in effect, multiple, concurrent behind-the-scenes processes. But Aldus shows no interest in updating the program for OS/2 2.0.

Microsoft, too, had a very good OS/2 1.1 version of Word, but don't look for *that* to appear in the 2.0 world.

New apps? IBM's well-publicized subsidy of some software houses' ports of DOS and Windows products to OS/2 will soon bear fruit. Borland, one of IBM's most conspicuous partners in OS/2 application development, should have Quattro Pro for OS/2 ready soon. And though IBM has been largely unresponsive to the cries of many small developers eager to bring out new OS/2 applications, some of those shops have persevered and will soon ship interesting OS/2 packages.

So the situation is changing, if slowly. When the razzle-dazzle OS/2 2.0 apps appear, you'll find me and my coconspirators writing about them, often with enthusiasm. As Windows does today, OS/2 will ride the coattails of these products and will benefit from the praise they earn in the press.

When this happens, it may seem as if The Great Conspiracy has crumbled and we've all changed our minds about OS/2. That's unlikely: We'll simply have found some OS/2-based apps to write about.

Good applications sell PC hardware; good applications sell operating systems. And good applications are precisely what OS/2 2.0 must have to succeed. □

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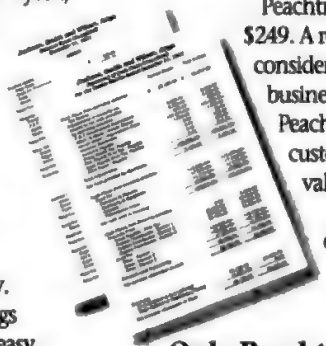

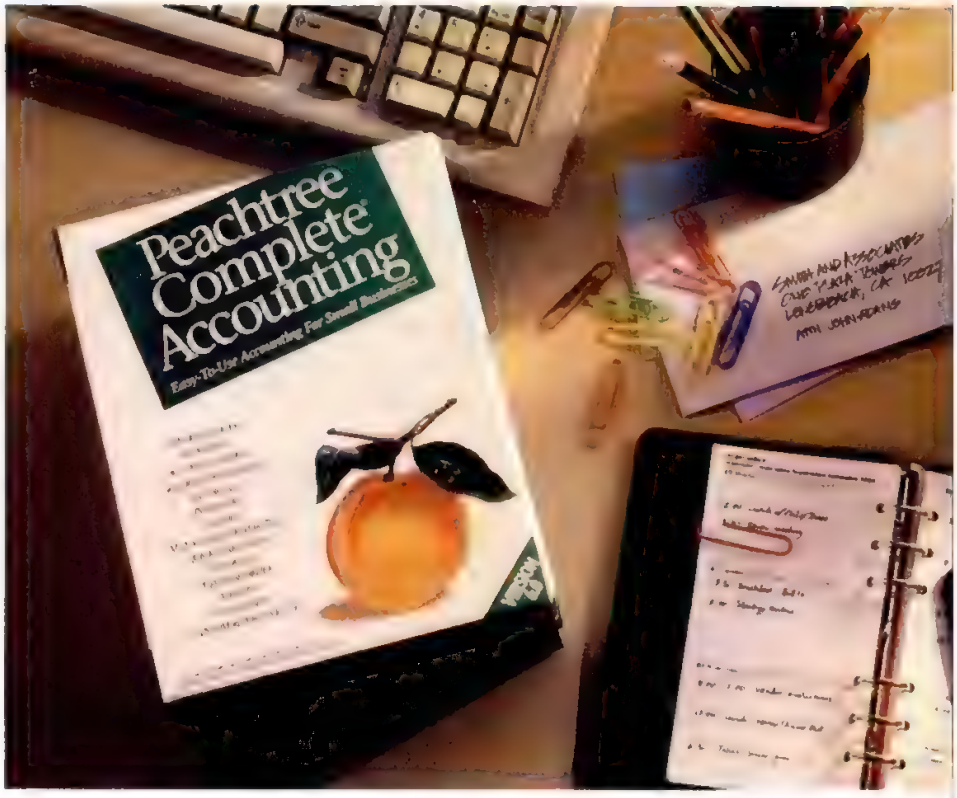

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CIRCLE 358 ON READER SERVICE CARD

SOME COMPANIE
WILLING TO PAY FOR A
IT'S THE ONL

Design. Engineering. Testing. Service. Support. When you think about it, these are what make one computer better than the next. Which makes it all the more surprising that companies are cutting back in these areas. And, amazingly, some do little but stick their name on at the end of somebody else's assembly line.

It would be like buying a car, looking under the hood, and discovering that it was built by a company you'd never heard of from a place you'd have trouble finding on the map.

It makes you wonder about the kind of company that would do it. Why they would make the decision to put their name on a product over which they maintain little control. And why they would then sell it to their customers.

Obviously, at some point during some meeting in some boardroom, the mandate came down:

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far as to withdraw th

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compatibility guarantee for the Dimension Line.

Comparing COMPAQ computers with today's "name brand" clone PCs reveals other important differences as well.

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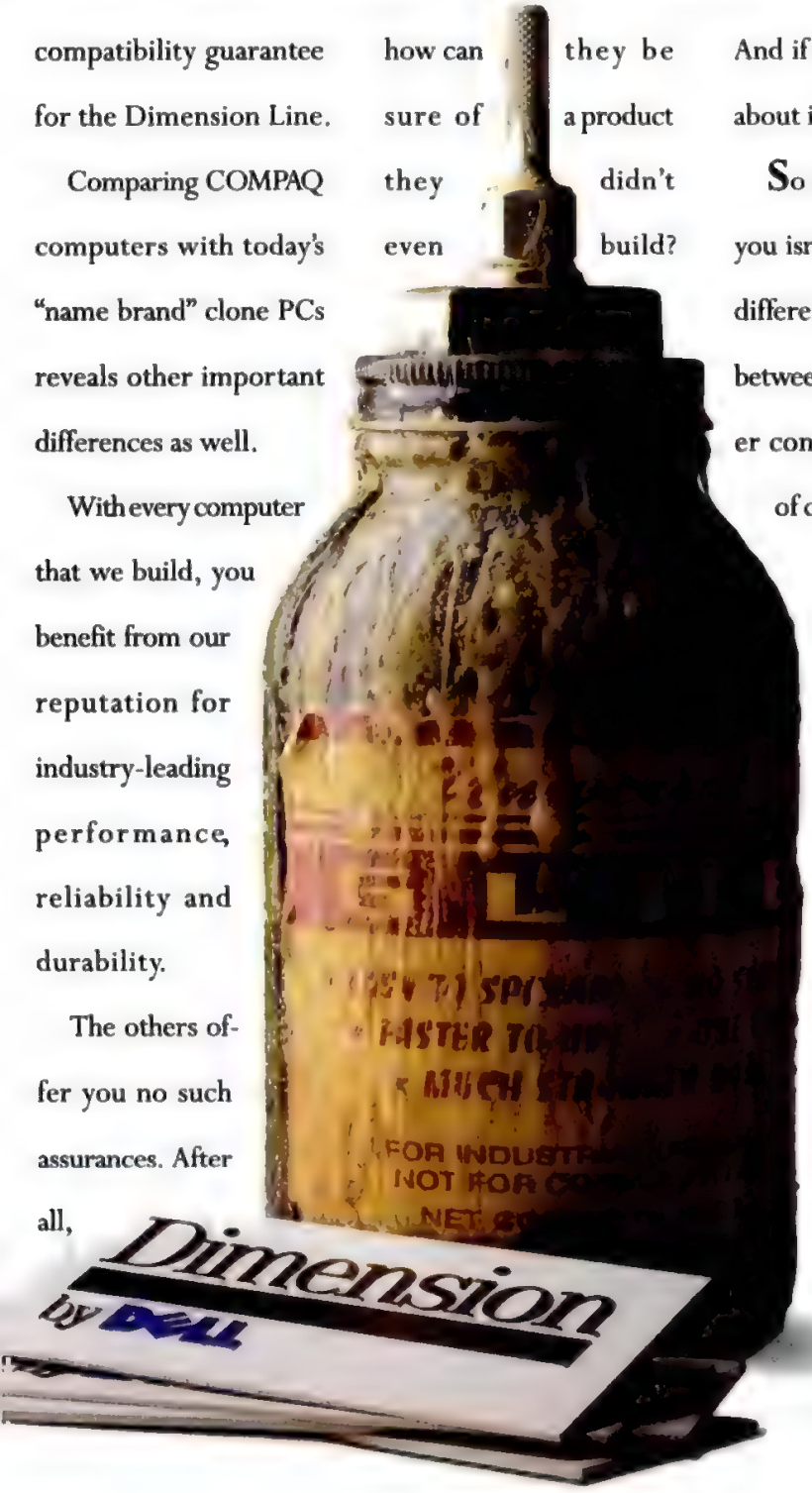

And if they can't be sure about it, how can you?

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CIRCLE 137 ON READER SERVICE CARD

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CIRCLE 118 ON READER SERVICE CARD

William F. Zachmann

A Technological Crossroads

We are currently at a crossroads in two important technology cycles. It's the end of both a very long-range, 50-year cycle and an intermediate-range, 10-year cycle. These two points define the industry's present condition.

The 50-year cycle is the era of traditional mainframe and minicomputer systems. This period began with the invention of the modern electronic digital computer in 1946 and the innovation of the business computer in the early 1950s. The 10- to 12-year cycle is that of the personal computer used primarily as an individual productivity tool.

The first five decades of the modern digital age have been dominated by proprietary system architectures, operating systems, and networking. Each computer vendor—IBM and every other mainframe maker, Digital Equipment Corp. and every minicomputer maker—necessarily had to create unique system, software, and network designs.

During this period, users became wedded to the architecture of the vendor they chose. Their investment wasn't in computers but in the specific systems of a specific vendor. Once the buyers chose a particular vendor's equipment, they could not easily switch to that of another. The conversion costs were too large.

Because of these proprietary architectures, this portion of the computer industry was able to operate under what amounted to a quasi-monopoly. To the degree that a computer vendor established an installed base of systems, that vendor acquired the franchise over that installed base.

The more recent era of information systems, however, is marked by standard system architectures, operating systems, and networking. Characterized by the personal computer revolution of the 1980s, this era brings far more competition and aggressive pricing because no vendor can establish a quasi-monopoly.

Personal computers first appeared in the late 1970s. The introduction of the IBM Personal Computer in 1981, however, set off the tremendous explosion in use of personal computers that made them the fastest growing segment of the industry in the eighties.

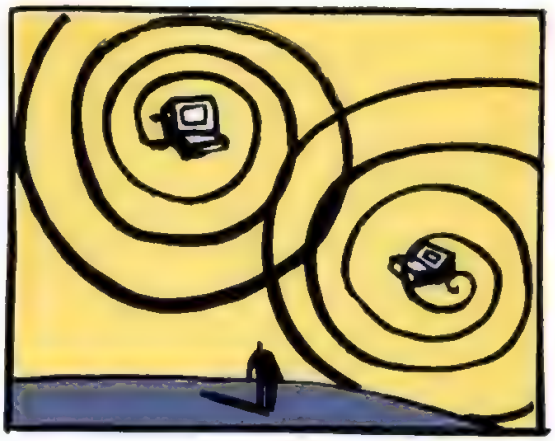
Until very recently, however, personal computers were most often used alongside, rather than instead of, traditional mainframe systems. The trend that I believe I was the first to call "downsizing" in 1985 did not become a major theme for the computer industry until the very end of the 1980s and early 1990s.

Now two crucial developments mark the end of these two very important technology cycles. The direct assault by micro-based systems on the traditional role of mainframe and minicomputer systems has begun. At the same time, the growth rates in the personal computer market as we knew it through the eighties are topping out as the PC market becomes saturated and increasingly becomes a replacement market.

The result is that both the traditional market for mainframe and minicomputer systems *and* the traditional market for PCs are entering a period of stagnation, if not outright decline. The troubles of the traditional mainframe and minicomputer vendors, the recent precipitous drops of personal computer prices, and the rapidly developing shakeout among PC vendors are evidence of this new phase for both parts of the industry.

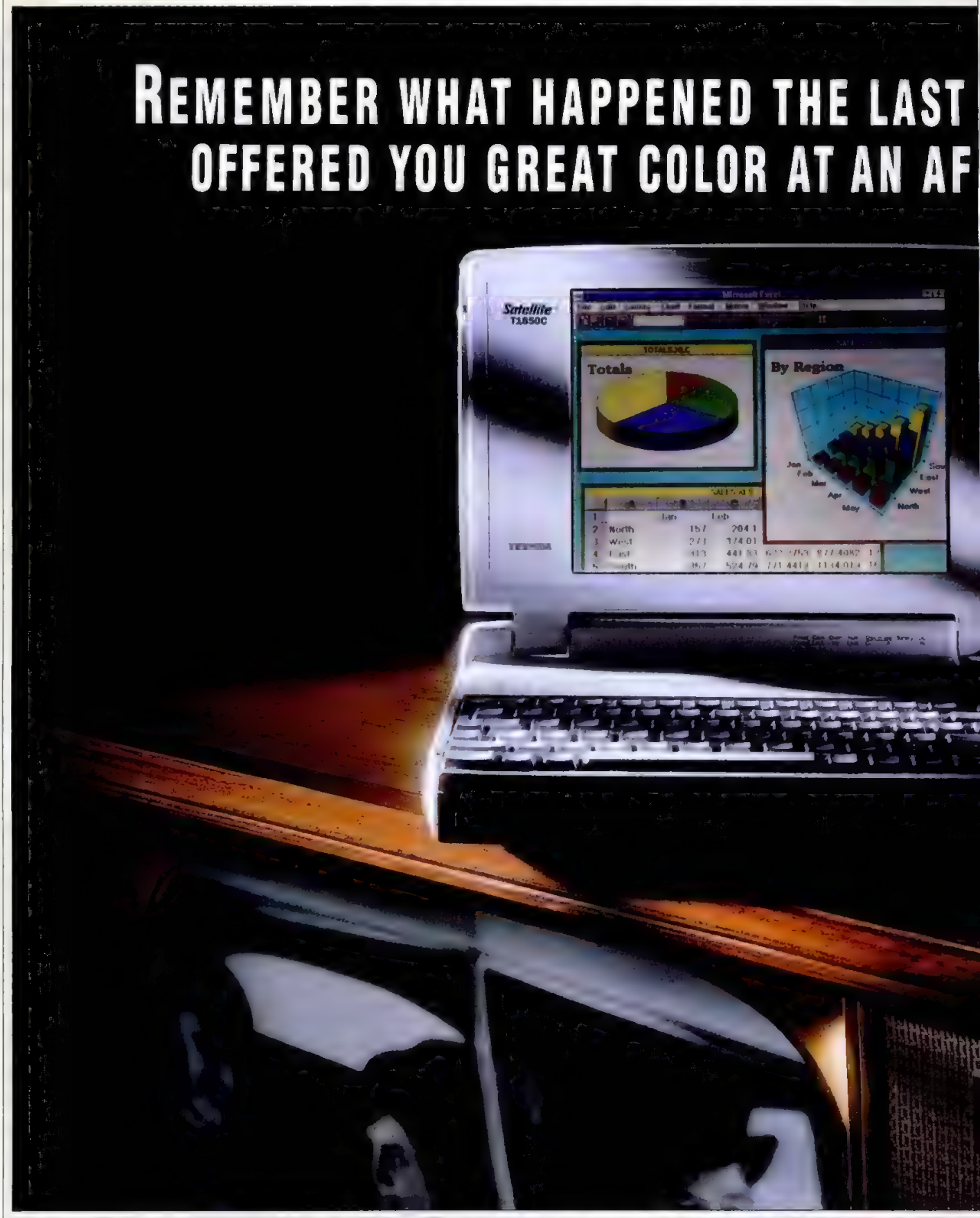
All these factors set the stage for the immediate future. The keys to growth in this period will be in the use of microprocessor-based systems as platforms for building industrial-strength applications—the sort of applications that formerly required traditional mainframes and minicomputers.

The end of the decade shows promise, but I'll save that topic for my final column in the next issue. □



When two technology cycles come to a close, a period of stagnation becomes inevitable.

Illustration by Alison Seiffer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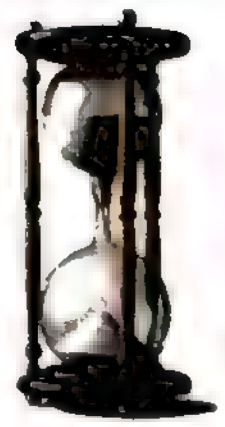

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You can call real live Toshiba technicians toll-free for complete product support.

When the first color television came out, black and white was history. This is another red letter day in the march of technology.

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We've also utilized an improved color filter for eye-popping richness and purity of color. And with a contrast ratio of 10:1, colors have never been more distinct.

Of course, like other notebooks in our Satellite series, the T1850C comes with a rapid fire 25MHz 386SX microprocessor, 4MB of RAM that can be expanded to 12MB and your choice of an 80MB or 120MB hard drive.

But for a true picture of just how great the color on the T1850C is, we invite you to place it side by side with other color notebooks. A demonstration that should convince you not only are ordinary monochromes on the way out, but a number of ordinary color notebooks as well.

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CIRCLE 379 ON READER SERVICE CARD

Get a better de
on a better 1-2-

Now that's good news for anyone buying a Windows™ spreadsheet. First, we recently updated 1-2-3® for Windows so it now gives you more of the features you've been looking for in a Windows spreadsheet. Second, we lowered the price to just $495.* (Plus, for upgraders, and for a limited time only, we've included the SmartPics™ Clip-art Sampler absolutely free.)

$495

Of course, when you come right down to it, there are plenty of other reasons why 1-2-3 for Windows is the best spreadsheet choice you can make.

Its features and performance are better than ever.

1-2-3 for Windows now includes more than 25 new features and usability enhancements, as well as a robust set of GUI development tools.

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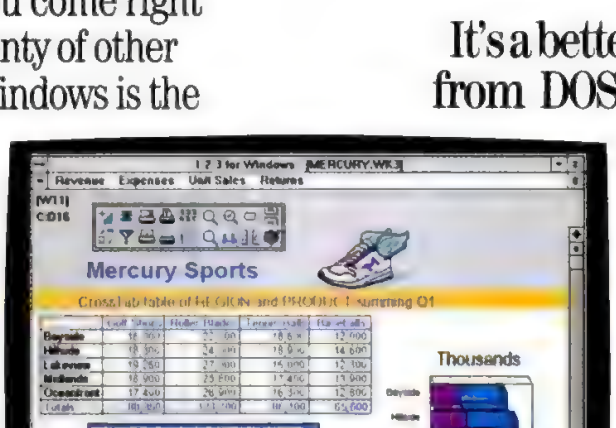
Better still, we're offering license packs for network users so you can set up your network configurations more cost-effectively. All of which makes Lotus 1-2-3 for Windows the best deal in a Windows spreadsheet.

It's a better transition from DOS to Windows.



Only 1-2-3 for Windows, with its built-in Classic® Menu, lets you use familiar 1-2-3 commands whenever you choose. Excel, on the other hand, only supports 80% of 1-2-3 Release 2.01 commands. And has no support for releases beyond.

*Suggested retail price. **In Canada, call **1-800-GO-LOTUS.** Eligible spreadsheet products include 1-2-3, LotusWorks, Symphony, Microsoft® Excel and Quattro® Pro. Please have your credit card and product package ready when

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al 3.

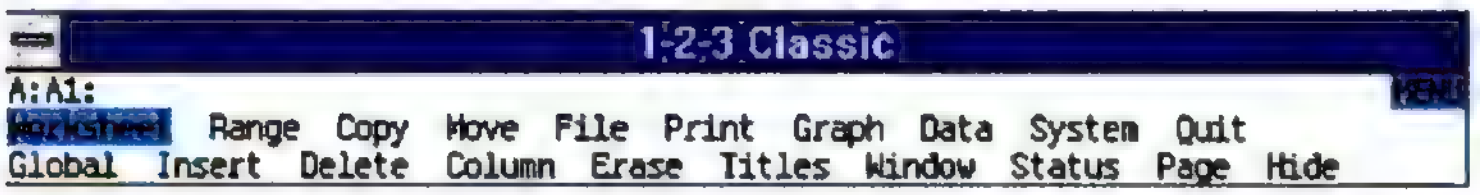
What's more, only 1-2-3 for Windows offers you a better compatibility bridge from DOS to Windows. And unlike Excel, which can't read Allways files, 1-2-3 can read and execute *any* 1-2-3 for DOS file, style and macro.

All of which means you'll retain your full investment in 1-2-3 for DOS files when you move to 1-2-3 for Windows.

Its 3D technology and external data access capabilities are better than Excel's.

In 3D technology, 1-2-3 is unsurpassed. It gives you easy access to 256 worksheets and lets you build true 3D formulas. Excel's Workbook is a mere imitation. That makes 1-2-3 for Windows a more powerful tool that truly helps you consolidate data, spot trends and make better, more timely business decisions.

Corporate Computing (8/92) wrote that *"for the experienced 1-2-3 database user, 1-2-3 for Windows with DataLens® is the front-end tool of choice."* Excel's data access capabilities rely on a third-party product with limited relational capabilities.



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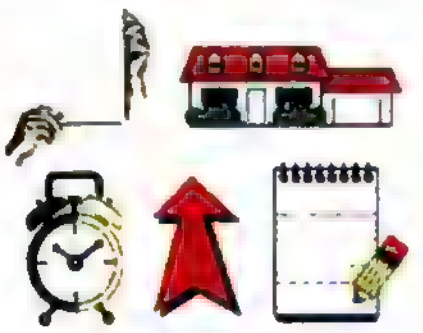

Of course, we still offer our unique Technology Guarantee which allows you to upgrade for just $49 to any new version of 1-2-3 that is introduced within six months of your purchase.

So if you're ready to take advantage of this great upgrade offer, just see your Lotus® Authorized Reseller or call **1-800-TRADEUP, ext. 7171.****

Lotus 1-2-3 for Windows

you call. Offer expires 12/31/92 or while supplies last. 1-2-3 for Windows is also available on CD-ROM, with Multimedia SmartHelp™. © 1992 Lotus Development Corporation, 55 Cambridge Parkway, Cambridge, MA 02142. All rights reserved. Corporation. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation. PostScript is a registered trademark of Adobe Systems Incorporated. Quattro is a registered trademark of Borland, Inc.

SMALL, LIGHT, AND CAPABLE

Upgradable PCs

Your next computer may be designed specifically with upgrading in mind—by replacing the processor, plugging in a proprietary card, or using a zero-insertion-force socket. To see which approach makes the most sense, *PC Magazine* tests 48 systems designed to keep up with the new technology.

by Jim Seymour

Our discontent may not be quite divine, but it certainly is *deep*. No matter which PC we have put on our desks today, by tomorrow morning we start feeling the itch to perk it up a little. What once dazzled us with its speed seems now to crawl; what once seemed capacious now seems cramped; what once was state of the art is now boring.

Maybe it's in our genes.

The PC industry, always ready to scratch our every itch, has from the first days of the IBM Personal Computer, more than a decade ago, responded with an incredible flood of upgrade products. If the 16K of RAM in your first IBM PC was too little—and of course it was—vendors stood ready to sell you a variety of products. These included memory chips; multifunction cards that let you increase memory to a then-almost-unbelievable 256K, 512K, even 640K; and additional serial and parallel ports, maybe even a game port.

Two early hits in the PC business, Quadram Corp.'s Quadboard and AST Research's SixPack, exploited the "expansion slots" built into that first, feeble IBM PC and nearly every desktop PC since, and baited the trap for literally millions of upgraders to come.

Driving this urge to upgrade is the inherent modularity of PCs. Look at your PC as basically a card cage, a power supply, a few basic circuit boards, a keyboard, and a monitor, and you've got the picture. It practically cries out for more, more, more.

So, of course, do *we*.

Today, a very significant part of the PC business has become a replacement business—selling second, third, or fourth generations of PCs to people and companies already in the game. And for the last two years, the buzzword has been upgradability.

There are many steps beyond replacing your CPU to bump up the performance of your machine. These include installing more memory or a larger hard disk, speeding up video performance, or installing a new, faster CPU chip.

We're now seeing new PCs that, through one means or another, promise an extended adolescence and a distant obsolescence by letting us easily swap out parts. The resulting performance of some of these upgradable PCs runs neck and neck with the industry's best machines, but other upgradables are a few paces behind, and there are several laggards.

REVIEW CRITERIA

In this review, we look at upgradable systems that have at least three CPU options, along with several Editors' Choice winners from our issues of September 15 and October 13, 1992. Here and in the

Photograph by Ernie Friedlander

Upgradable PCs

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pages that follow, you'll find our assessment of 48 new PCs that have been promoted by their makers as being easily upgradable and were shipping to customers by late summer. All machines were tested by the last week in August, and prices are current as of the first week in October.

Several machines were withdrawn: The Cumulus GL had a motherboard failure, and the vendor was unable to send a replacement in time for testing. Micro Express's ME 486-SX/25 EISA had a prototype BIOS and could not be considered a shipping unit. Digital Equipment Corp. has stopped selling its DECpc 400ST and has replaced it with the DECpc LP, which was not yet available at the time of our testing.

Both PC Magazine Labs in New York and our corporate ZD Labs operation in the San Francisco Bay area focused on these new machines, to find out which deliver on the promise of easy upgradability and offer the most bang for the buck.

We found three general approaches to upgradability, each of which can cause differing levels of installation anxiety. The most popular approach involves pulling the microprocessor from its socket and replacing it with a new chip, then making some changes in the BIOS—although with too many machines the process can become more complicated.

A slight variation makes the installation process less nerve-wracking. Adding a ZIF (zero-insertion-force) socket makes chip installation as easy as pulling a lever. A third solution is to design the system around a daughterboard that has a processor and, possibly, some of the support circuitry.

For an alternative to these three approaches, contributing editor Winn L. Rosch takes a look at motherboard swaps for 286 and 386 systems (for more information, see the sidebar "486 Upgrade Alternatives").

This story also marks the rollout of our new series of benchmark tests. See this issue's Lab Notes (page 393) for details on how we've upgraded our tests to reflect today's more complex personal computing environment. For the reviews in this story, we've also upgraded our Windows benchmark test by improving our Graphics Winmark procedure and instituted a new Disk Winmark.

DOLLARS AND SENSE

Whether you're looking at new PCs that promise easy upgrades, or thinking about upgrading your present box, consider the economics of the move. If you can get easy upgradability thrown in essentially for free in a price- and performance-competitive machine, that's an easy choice: It's a no-brainer to choose flexibility for the future, even if you don't think you need it now. But think twice before spending any extra money for that upgrade path, and think three times before buying an upgradable machine that has any type of 386 CPU, unless it can accommodate a 486 processor and beyond.

If all a new machine has to offer is an easy route to upgrading, consider how likely you are to need an upgrade, and especially whether the components you will want to upgrade are the ones the vendor is touting as easy to replace. Consider also how much of a boost the upgrade will really deliver and at what cost.

In practice, only a small percentage of the owners of upgradable PCs will ever buy and install the upgrade kits offered by the makers of their machines. And Intel's introduction of OverDrive chips, which offer easy, user-installable, plug-and-play upgradability to faster microprocessors by adding the chip to a socket on a PC's motherboard, seems likely to reduce even further the number of PC owners who turn to their PC supplier for a proprietary CPU upgrade.

The advantage of upgradability lies in the ease of swapping the CPU chip for a later, hotter chip design. Among the 48 machines we tested, many have the ability to move up the processor ladder to Pentium, which is expected early in 1993. (Pentium is Intel's next-generation chip, known in trade speculation as either the 586 or P5.) Several machines we tested have replaceable motherboards designed to operate with a 32-bit data path, and can use Intel's newest creation. But these machines may not be able to take full advantage of Pentium's many benefits, because they weren't designed for it.

Our Contributors: OLIVER RIST is a staff writer at *PC Magazine*. WINN L. ROSCH and JIM SEYMOUR are contributing editors to *PC Magazine*. WILLIAM P. FLANAGAN is a support technician at PC Magazine Labs.

PC MAGAZINE

EDITORS' CHOICE

• Compaq Deskpro M

The possibility of upgrading your stodgy old desktop computer quickly, simply, and cheaply may sound too good to be true, and in some cases we discovered it is. While examining the 48 systems in our roundup, we found too many whose upgrade path was anything but the touted straightforward, easy route by which even a novice user might supercharge a PC. In other cases, the post-upgrade performance was a disappointment, or the cost of the base machine plus the upgrade (we assumed that the owner would install the upgrade) was significantly more than if you had purchased the computer you wanted all along.

Our primary guideline in deciding which upgradable computers stood out from the rest was: The less you have to do, and the more you get, the better. A number of entries deserve recognition, but only one wins an Editors' Choice: the Compaq Deskpro M.

Honorable mention goes to three computers that are clearly superior to the pack, even though they are disappointing in one area or another: the AST Power Premium, the Standard Advantage EISA, and the Swan Direct Bus Line. The two ZDS Z-Station computers are difficult to upgrade but are the only machines in this review to come with built-in network cards.

The Compaq Deskpro M was an Editors' Choice in the 486DX2/50 class of processors reviewed in our September 15, 1992 issue. For easy upgrading, this machine is in a class by itself. Techno-junkies and techno-phobes alike can change from a 386DX/25 all the way to the fastest chip available today in about 5 minutes. All the important components are easily accessible in the computer's well-designed and neatly organized interior.

The key element of Compaq's upgrade design is that the snap-in processor board contains not only the replacement CPU, but the clock crystal, external cache, and system memory as well. Of the five plug-in processor upgrade boards that we tested, two performed exceptionally well: Compaq's 486DX2/50 and 486DX2/66 had the fastest processor scores in their classes; choose either and you will have performance that is without peer among upgradable PCs.

Not only did the Deskpro M excel in its performance across the processor groups tested, but Compaq's QVision video adapter continues to receive rave reviews; it also captured the highest Graphics Winmark scores we've seen in several processor classes.

While the Deskpro M's price tag may make some potential users who are budget-minded blanch, the product's upgradability can justify the price by extending the machine's useful lifetime by several years.

HONORABLE MENTION

We found the simplicity of AST Research's Cupid-32 upgrade path for its Power Premium series of PCs very appealing. All you need do is slip in the full-length board that holds the processor and RAM—no fishing around for jumper switches that are the size of push-pins. The only change you need to make is to reconfigure the flash memory BIOS. This requires only an easy software upgrade, rather than replacement of the ROM chip.

Swan Technologies also deserves recognition for its plug-in upgrade card, but its Direct Bus Line goes a step further by automatically detecting the new processor and adjusting the BIOS and clock crystal to the new settings. The product's slightly better-than-average scores on our benchmark tests are undercut by a subpar graphics adapter and monitor.

Upgrading the Standard Advantage EISA would be easier if the vendor had included a ZIF (zero-insertion-force) socket. But the roomy tower offers enough accessibility to make using a chip puller tolerable. The process is not nearly as annoying as in situations where getting near the motherboard means fighting with tangled wires, cross-braces, and drives. The usefulness of the package's bundled software is a bonus.

The two ZDS Z-Stations in this review disappointed on several fronts—cases that aren't sturdy enough, disk drives that get in the way of upgrading, and unimpressive monitors—yet both the 420Sn and 420SEh stand out in one area: integrated networking. The Ethernet module for each machine is ready to go, and the systems include three popular network packages already loaded on their hard disks, making for instant communications.

The current cost difference between a 386 and a comparable 486DX or 486SX machine is usually a few hundred dollars. Choosing the computer with the more powerful chip makes sense, because the cost of the 386 plus the upgrade is usually more than you would spend on the 486 machine in the first place. Corporate managers also like to see a single system that can be configured with an array of processors, since this lowers the need for, and the cost of, support and training.

The obvious counter to the argument for choosing the more powerful technology is that you may not be able to afford that extra cost right now, but should be able to at some point in the future. That's the pitch vendors make for upgradables. But that pitch could represent poor economics for the buyer, who's often better off wringing a few more dollars out of the budget today (or even waiting a few months) rather than buying one CPU with the machine and a second one later.

At the very least, be careful about prices, and what you get for those prices. Many of the machines tested here—even after being upgraded—would be considered mediocre compared with other, similarly priced PCs not touted by their makers as specifically upgradable.

EASY AS PIE...?

Don't be blinded by manufacturer claims of childishly simple upgradability. Indeed, the complexity of upgrading some of these so-called "upgradables" led us to wonder just how far the term "simple" can be stretched. This is not to say that these upgrades were impossible. In many cases, we found that a well-informed computer user could, within a reasonable amount of time, successfully complete the upgrade.

Proprietary CPU upgrades in these machines usually consist, at a minimum, of pulling out the existing CPU and replacing it with a new one; removing the old clock oscillator and replacing it with another, faster version; and, almost certainly, resetting some of the jumpers on the motherboard. You may well have to swap the system's ROM BIOS chip also.

None of that is exactly brain surgery, but it can be daunting—particularly if it's your first attempt at such a procedure. Be aware that there are pitfalls, from static electricity to dropping tools into the CPU case. It's also too easy to bend a few of the 168 pins on that pricey new Intel CPU so that it can't be installed at all—especially if you swap chips that are sitting in standard sockets rather than in the nifty new lever-action ZIF chip holders.

Even if you're an old hand with a chip-puller and maybe even a soldering iron too, you will find that the upgrade procedure for some of the machines is too convoluted, poorly documented, or both.

About one in five upgrades proved to be too difficult and time-consuming for even an experienced technician to accomplish. We found far too many hard-to-reach or downright inaccessible chip sockets; situations in which you have to remove hard disks and even their bays to gain access to the proper chip socket; systems that require removing the entire motherboard to install a chip-and-oscillator upgrade; and setups in which even dainty Tinkerbell herself would have to strip all the expansion boards out of the system to get an upgrade into place.

As if that isn't enough, some of the documentation we reviewed contains contradictory information and gives the wrong setting for new jumpers.

That's not the end of the difficulties we discovered, either. Comtrade asks upgraders to unsolder the old clock crystal from its motherboard and resolder a new one in its place—in a tight corner, too, just to make it more fun. Motherboard soldering is tricky at best, and fraught with danger: Even experienced technicians hate it. And Diamond Technologies should win a booby prize for silk-screening onto its motherboard an incorrect, distinctly nonworking position

HIGHLIGHTS

Upgradable PCs

THE PRODUCTS with the easiest upgrade tended to be the most expensive. These are machines such as the ASR Power Premium and the Compaq Deskpro M, for which RAM, CPU, and cache are located on a daughtercard.

DON'T PAY EXTRA for upgradability. Systems like the BOSS CEO, which is priced at almost $7,000 with a 486DX2/50 CPU and designed for easy upgrades, appear overpriced.

THE COMPAQ DESKPRO M series set the standard for the ease and simplicity of changing processors. Based on processor cards that span CPU classes from 386DX/33 to 486DX2/66, this PC's upgrade board also contains an external cache and a second processor socket on some models.

THE COST of a lower-model PC and its upgrade parts, in many cases, was higher than the cost of buying the top-of-the-line machine in the first place, negating the economic incentive of upgrading in the future. A better approach is to spend the extra money now and enjoy a faster, more powerful computer from day one.

CHOOSE A MACHINE that has a logical layout; steer clear of machines with inaccessible motherboards that require you to remove major components such as hard disks just to reach the CPU.

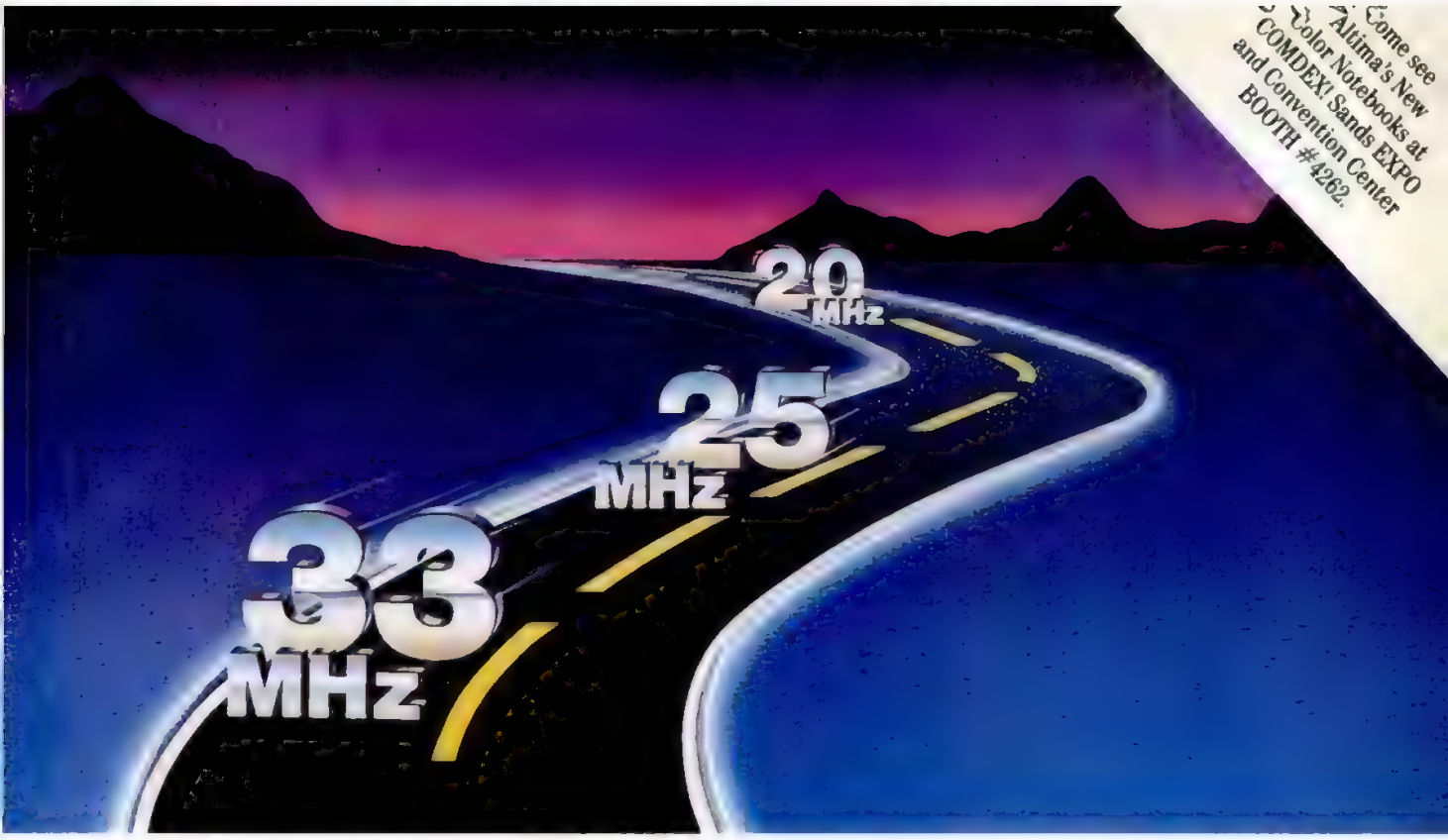
ZERO-INSERTION-FORCE (ZIF) sockets make the job of changing the microprocessor as easy as pulling a lever to release the old chip, dropping the new one in, and pushing the lever back. In general, it reduces upgrade anxiety levels. Micro Express's ME 486-Local Bus and others had this feature.

THE CUPID-32 processor upgrade card, from AST, uses full-length cards to replace the CPU and RAM, allowing for quick and easy upgrades. In addition to an empty socket for a coprocessor, the Cupid-32 contains a marvelously easy flash BIOS upgrade that allows a simple software change, rather than changing a ROM chip.

CONSIDER UPGRADING other equipment such as the hard disk, whether by installing a Hardcard, an additional internal hard disk, or compression software (such as Stacker) to increase data storage. Additional RAM is often the most cost-effective way to increase system performance.

MAKE SURE performance increases commensurately with the upgrade. For instance, the Lightning Omniflex 486 with a 486DX/25 chip significantly outperformed the Mitsuba Professional Upgradable with a faster, 486DX/33 processor.

BETTER VIDEO may be a smarter upgrade strategy than a "brain" (processor) transplant. Try a new video adapter that can handle higher resolutions and a larger palette of colors. It is a very cost-effective way to increase Windows performance. □



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The 486 notebook that lets you shift to another gear.

The power you need from your computer today may not be enough for tomorrow. But now, thanks to the new Altima 400 Series, you can rev the processor from a speedy 20 or 25 to a screaming 33 MHz 486DX with math coprocessor. So instead of buying a new computer later, you simply buy more speed and power when you want it.

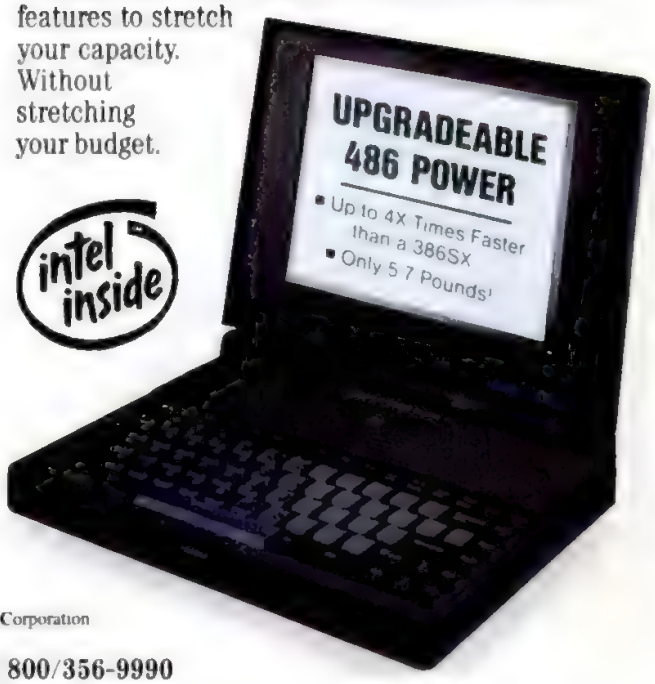
Upgradeable and affordable, the Altima 5.7 pound, 486 notebook runs about the same price as most 386's.

Optional Trackball Shown Actual Size

The 400 Series is up to 4-times faster than a typical 386SX, plus it features 64 level gray scaling (not 32); a large 10" diagonal screen; simultaneous display on LCD and external monitor; hard disks with up to 120 megabytes; and a keyboard arrangement that makes sense, not sacrifices.

For even greater flexibility, Altima offers options to put you in the express lane. Like an integrated trackball that snaps right into the unit. Or an internal modem with 2400 BPS, MNP-5 Data and 9600 BPS send/receive fax. There's even a DC adapter for your car.

Shift to the New Altima 400 Series. It has the features to stretch your capacity. Without stretching your budget.



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CIRCLE 198 ON READER SERVICE CARD

Price/Performance Index: *Upgradable PCs*

Most of the 48 upgradable systems we tested are grouped at the center of the chart in terms of performance, although there is a great deal of variation with regard to price.

At less than $3,000, the two Micro Express systems (the ME 486-Local Bus and MicroFLEX) are in a dead heat for the optimum price/performance rating. Keep in mind that questions concerning hardware failures and the company's reliability are not yet resolved. There is a group of four systems that exhibit impressive performance, but at higher prices. Of these, only the Diamond DT486XI provides what we would call an easy upgrade path; the Axik Ace Cache 486ALL! Series, Deico Predator, and Mitsuba Professional Upgradable were disappointing when it came to the user's ability to update the system.

In terms of price, the Compaq Deskpro M series of upgradable computers costs significantly more, though it provides an acceptable compromise between price and performance while giving the user one of the easiest upgrade paths we've seen so far. Also exhibiting a good mixture of performance and upgradability is the BOSS CEO, though its $6,995 price tag with a 486DX/50 CPU is hard to swallow.

On the left side of our chart, the big disappointments of the test group were the AcerPower 386/SX, the ALR Flyer 32DT and ALR PowerFlex Flyer, and the two Zenith units (the ZDS Z-Station 420SEh and Z-Station 420Sn). They spanned a price range between $2,000 and $5,000 but failed to deliver performance.

THE DATA POINTS

The performance/features axis of the Bang for the Buck chart is based on nine data points for the highest-level processor available: the DOSmark, Graphics Winmark, Disk Winmark, installed RAM, disk capacity, VGA RAM, free slots, drive bays, and extras (such as free bundled software, a mouse, on-site service, an extended warranty policy, and a flash BIOS system). We have weighted the raw data so that performance and features each make up half the total score. Prices were based on the tested configuration; we applied a 15 percent discount to machines that vendors sell through dealers. You can find this data in the Software Library of PC MagNet's Editorial Forum as 21BANG.WK1.

The tested-configuration price (as listed in the corresponding fact file) determines each system's location on the *y*-axis. We applied a 15 percent discount to the list prices of dealer-distributed systems to approximate street prices, so these prices will differ from those listed in our fact files.

Free software included*
Trivial Pursuit
Daily Planner
$69.95 value

The not-so-hard drive upgrade.

The Hardcard EZ™ hard drive is absolutely the easiest way to add high-performance drive capacity to your system.

And choosing the Hardcard EZ drive is even easier, because Quantum guarantees it's compatible with everything else in your computer — or your money back.

It's guaranteed to run with any 286 or later PC/AT system and all your popular operating systems like MS-DOS, OS/2 and Microsoft Windows. It's guaranteed to coexist with your current drive, too. So you don't sacrifice existing storage to increase your capacity.

The Hardcard EZ drive is a full-featured, high-performance Quantum hard drive.

And anyone can install the Hardcard EZ hard drive — even if you've never seen the inside of a computer. Just drop it into an expansion slot, run the automatic installation software, and you're ready to grow with 42, 85, 127 or 240 MB of added capacity.

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Manufactured by the makers of the original Hardcard® hard-disk-on-a-card, Hardcard EZ upgrades contain full-featured Quantum drives renowned for the highest performance and reliability and backed by a two-year worry-free warranty — twice as long as most other drives.

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CIRCLE 084 ON READER SERVICE CARD

The new IBM Color
produce some pretty

Even compared to the competition's simpler PCL 5 mode, our built-in PostScript emulation prints 44% faster, on average.

True 360 dpi and ColorGrade enhancement, for color quality you'd normally expect only from 600 dpi printers.

Lexmark announces a color printer so fast, sharp and value-packed, it redraws the boundaries of desktop color: the new IBM® Color Jetprinter PS 4079.

It lists for just $3495, like the HP PaintJet XL300,® and works with both Macs *and* PCs.

But unlike the PaintJet, the IBM Color Jetprinter PS delivers true 360 × 360 dpi and advanced ColorGrade™ enhancement—for smoother blends, stunning detail, and up to three times as many brilliant colors.

It's faster, with an AMD® 16 MHz RISC processor and *true* 32-bit architecture.

It's easier to share: up to three simultaneous inputs accommodate PCs, Macs, even IBM RS/6000® workstations. And SmartSwitch datastream sensing switches automatically between built-in GL plotter and PostScript® emulations.

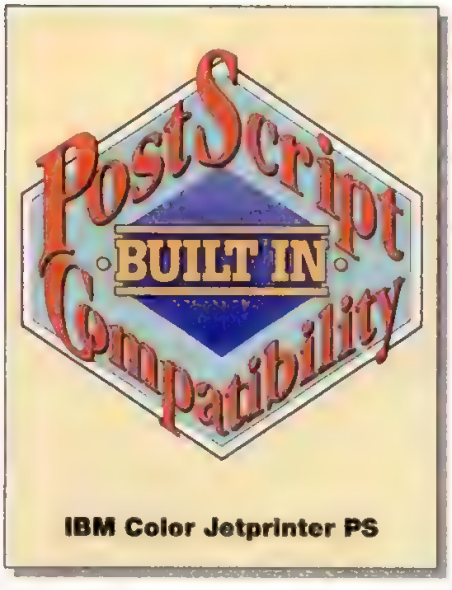
Best of all, the IBM Color Jetprinter PS is PostScript-compatible, right out of the box. (The competition makes PostScript a $1500 extra.) It handles

Speed comparison based on independent testing. IBM is a registered trademark of International Business Machines Corporation in the U.S. and other countries and is used under license. RS/6000 is a registered trademark of International Business Machines Corporation. AMD is a registered trademark of Advanced Micro Devices, Inc. HP PaintJet

THE IBM COLOR JETPRINTER PS:

Jetprinter PS can impressive graphics.

Value



IBM Color Jetprinter PS

(Sorry—PostScript upgrade costs $1,500 extra.)

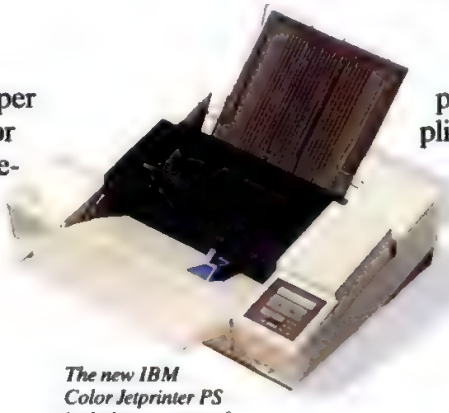
HP PaintJet XL300

For the same $3495 list price, we build in PostScript compatibility and 11" × 17" printing. Instead of making them expensive options.

transparencies and 11" × 17" paper without expensive extra trays, or additional memory. It's Pantone-licensed, too.

And it comes from Lexmark International, an independent worldwide company, formerly a division of IBM, that develops, manufactures and markets IBM personal printers, IBM typewriters, related supplies, and keyboards. For your nearest dealer, call 1 800 358-5835 (in Canada, 1 800 663-7662).

And let Lexmark's latest breakthrough show you some impressive color values. And some very sound economic ones.



The new IBM Color Jetprinter PS includes one year of free, onsite service.

IBM Personal Printers by

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CIRCLE 116 ON READER SERVICE CARD

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COLOR MADE BRILLIANTLY CLEAR.

for the critical Pin 1 locator.

In contrast, the strengths of daughtercard processor upgrades, such as AST Research's well-proven Cupid-32 card and the Compaq Deskpro M's upgrade module, are clear. AST's upgrade uses full-length expansion cards that hold the new CPU, all of the system RAM, and sockets for such extra chips as the Weitek floating-point math coprocessor. Swap one board and you're through. Even better, AST uses flash memory BIOS chips, so that after the card is in place, bringing your system BIOS up to date is merely a matter of running a program.

CLOSER TO HOME

Most of the considerations we have discussed apply to more traditional upgrades as well. For example, does the upgrade make sense economically? Would you be better off simply buying a new, up-to-date machine for about $2,500, rather than spending close to that updating an old one?

You also must consider which type of upgrade will give you the most cost-effective boost. If you're running Windows on a 3MB or 4MB 386 machine now, for example, few enhancements will provide as immediate a payback as adding more memory does. And with easily installable RAM chips and SIMMs (single in-line memory modules) selling at $40 or less a megabyte, adding four or five megabytes is a quick, easy, cost-effective upgrade.

And if your hard disk is starting to fill up with those infamous 8MB to 10MB Windows applications, maybe more storage is what you really need. For an easy, 5-minute upgrade, plug in a 105MB Plus Development Hardcard, widely available for about $400. For the data-hungry, the recently announced 240MB Hardcard might be appealing. Or look for a small, fast 3.5-inch 200MB-plus IDE internal hard disk, such as Quantum's ProDrive, Maxtor's MX7213A, Seagate's 3283A, or Western Digital's Caviar. These are solid, high-performance drives, and great bargains at about $500 to $600.

If you don't want to spend the money to add another drive, consider Stac Electronic's Stacker, a $90 software upgrade that doubles a hard disk's capacity with only a minuscule penalty in performance.

FLYING PIXELS

Another cost-effective way to make your computer work more efficiently is to bring your display technology up to date. Video upgrades are hot tickets these days. As with so many performance upgrades, the demand for enhanced video performance is driven by graphical user interfaces in general and Windows 3.1 in particular. But unlike some other enhancements, better and faster video provides a huge perceived increase in the performance of existing PCs.

If you're a typical user, you want faster video performance—faster screen rewrites and the ability to push pixels around more quickly—and you probably want a larger on-screen color palette and higher resolution as well. Standard VGA for Windows is 640-by-480 resolution with 16 simultaneous colors, not exactly wonderful. On a 14-inch-or-smaller screen, 640-by-480 looks okay, though

Once Again, CA-SuperCalc's Numbers Crunched 'Em.

VARBUSINESS
Spreadsheet Report Card 1992

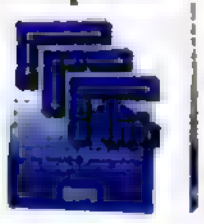
	Average Score	Access Tech.	Computer Assoc's	Lotus	Microsoft
PRODUCT FEATURES					
Ease of use	7.01	6.70	7.00	6.81	7.52
Memory requirement	6.40	6.82	6.89	5.71	6.18
Ease of programming	6.48	6.33	6.58	6.32	6.69
Ability to manipulate data	7.35	7.60	7.29	7.00	7.52
Sorting capabilities	6.90	7.67	6.64	6.58	6.73
Provision for software security	5.65	5.87	5.67	5.32	5.75
Report writing capabilities	6.14	6.57	6.28	5.89	6.82
Ease of use of interface	6.82	6.75	6.70	6.18	7.63
Software integration capabilities	6.84	6.94	6.82	6.32	7.31
Ease of data retrieval	7.41	7.56	7.52	7.10	7.44
Satisfaction with product profitability	6.21	6.47	6.44	6.05	6.89
Overall quality of product	7.48	7.28	7.72	7.18	7.78
Product features average	6.73	6.80	6.80	6.37	6.94
SUPPORT FEATURES					
Provision for customer support	5.88	5.06	5.97	6.47	6.02
Charges for training time	5.17	4.38	5.95	5.05	5.29
Provision for technical support	5.76	5.20	6.60	5.40	5.85
Provision for marketing support	6.65	5.00	6.40	5.43	5.75
Documentation & product information	6.85	6.25	7.27	6.77	7.13
Frequency of updates & revisions	5.99	6.06	5.95	5.84	6.10
Support features average	5.88	5.33	6.52	5.66	6.02
OVERALL AVERAGE	6.45	6.31	6.71	6.13	6.83

VARBUSINESS
March, 1992

This year's spreadsheet shootout is over. And like last year, the big winner is CA-SuperCalc.®

Coincidence? Hardly. Because once again, the judges were the people who know spreadsheets best – the ones who sell, install and support them for a living. Hundreds of dealers and resellers who know a good program when they see it.

CA-SuperCalc gives them plenty to see: spreadsheet linking, 3-D graphics, beautiful, presentation-quality output...and it runs on just about any PC.



According to the experts, it also outruns Lotus® 1-2-3® and Microsoft® Excel. What's more, Computer Associates' spreadsheet for DEC® users, 20/20, beat 1-2-3 as well, giving us two of the top four programs reviewed by VARBUSINESS.

As you can see, CA-SuperCalc dominated the product support categories, so you can buy it with confidence. And when you factor in the price – just $149 – you can buy it with ease.

Windows™ Version Coming Soon!
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Shouldn't you be using the spreadsheet that beat the big boys? CA-SuperCalc. Number One in number-crunching.

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Software superior by design.

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CIRCLE 400 ON READER SERVICE CARD

only 16 colors may not. But if you have a larger screen, you will want at least 800-by-600 and maybe 1,024-by-768, displaying at least 256 colors. You can push the palette up to 32,000 colors with a high-color RAMDAC-chip-equipped video card, or even to 16.8 million colors with a 24-bit card. Or with the same or better card and a 19-inch or preferably a 21-inch monitor, you can get to 1,280-by-1,024.

Improving video performance almost certainly means upgrading your present video display card, and it may mean a new monitor as well. The former needn't be expensive; the latter can (but needn't) be very expensive. The demand for faster, higher-resolution, and larger-palette video cards has already pushed down prices for high-performance video adapters, with some forecasters predicting a near free-fall in prices early in 1993, as fast 1,024-by-768-by-256 (resolution by number of simultaneous colors) cards become commodities. Today you'll pay from $200 to $500 for a performance-oriented card—including such gems as ATI's Graphics Ultra and Diamond's SpeedSTAR and Stealth—which often support pixel depths up to 1,280-by-1,024 with a 16.7-color palette.

But beware: Video upgrades can be performance traps as well as performance boosters. If you're accustomed to the screen-redraw speed of your present 16-color, 640-by-480 system and upgrade to 256 simultaneous colors at 800-by-600, you probably won't notice much slowdown in the time it takes to redraw your screen. One reason is because today's adapters and better video cards—which are almost certainly later designs than you're using now—can boost performance in a number of ways, such as better bit-block transfers, despite the greater number of pixels they must move.

But go higher in resolution or deeper in colors, and you'll really see things slow down. Hardware-acceleration technology offers hope to users committed to very high-resolution and photographic-quality color on-screen. But high-resolution video cards that offer a high degree of acceleration and an extensive palette cost $1,000 or more.

So you face a complicated choice: Just how fast, how sharp, and how colorful do you want to be, and how much do you want to spend to get there? A tip: Consider balancing high performance with high value by upgrading with a card that takes you to the 800-by-600 or 1,024-by-768 level, with 256 colors. Some of these cards cost less than $250.

BRAIN TRANSPLANTS

Vendors of upgradable PC's want to claim the high ground in CPU upgradability, but they hardly hold an exclusive on CPU swapping. As we've said, upgrading a 286 PC to a 386 or 486 machine is probably not worth the money and effort. But pumping up a 386 or 486 computer can enhance your machine at a price that makes sense.

And sometimes it's easy. If you have a PC with a 169-pin Intel-spec "performance enhancement" socket on its motherboard—almost certainly a 486SX PC—you're a potential customer for Intel's OverDrive series of microprocessors. Plug an OverDrive chip into the socket and you have the equivalent of an Intel 486DX2 CPU.

Whether the PC itself is the functional equivalent of a 486DX2 machine depends on other factors, such as memory, speed, hard disk size, interface performance, and video performance. But the OverDrive and DX2 chips are essentially the same, the former sold through end-user channels and the latter intended for OEMs only.

Even when the upgrade is not so easy to do, prying the old "brain" out of your box and installing a new one can be worthwhile. Though some vendors offer simpler ways of upgrading, such as plugging tiny daughterboards into a PC's existing CPU socket, a full-fledged motherboard upgrade is probably a better, safer path. In the process, you upgrade not only the CPU but also usually install newer, faster system memory, plus a new BIOS that has been designed to work properly with the new CPU. And there are, at least in theory, few if any compatibility problems with motherboard swaps, since everything that you'll find on the motherboard has been designed to work together.

In fairness, the deep-seated wish to upgrade our computers along the M/B/F (More/Better/Faster) axes isn't just self-indulgent techno-lust. The kinds of operating environments and application programs we rely on today are often fundamentally different, far larger, and more complex than those we used only two years ago.

When Windows and OS/2 2.0 need at least 4MB of RAM to make sense, and perform vastly better with 8- to 12MB or more, memories of 640K RAM-cram problems seem faintly sweet echoes of a distant, lace-curtained past. And when Microsoft assures us that it has a design goal of fitting the forthcoming Windows NT into "just" 8MB of RAM—that's for the operating system only, friends—but acknowledges that right now NT wants at least 12MB, the differences between Yesterday and Tomorrow become all the more clear.

So indulge yourself. Even if that machine on your desk today doesn't yet exactly wheeze and groan as you work, before much longer it will be a candidate for technology's attic. Whether you pursue one of the 48 explicitly upgradable PCs in the pages which follow, or pump-up Old Faithful with computing's equivalent of steroids, you're taking a smart step.

C'mon. Scratch that itch.

Acer America Corp.

AcerPower 386/SX

Acer America Corp. has recently reduced the price of the 25-MHz AcerPower 386/SX to $1,293. At that price it's a contender, with a fairly straightforward upgrade route to higher processor classes.

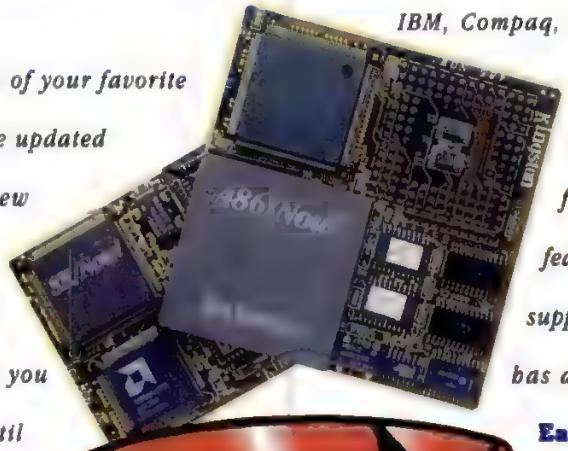
The AcerPower 386/SX

The standard small-footprint case is constructed of plastic with an aluminum lining that bent when we put a monitor on it. Power and reset switches are in front, as are the keyboard and PS/2-

A PC Is A Terrible Thing To Waste.

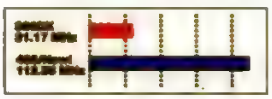
IBM PS/2 Models 70 & 80 and Compaq Deskpro 386 systems have a future with 486/Now! processor upgrades.

Every year or so, a new version of your favorite software comes out. Ideally, the updated version is easier to use, has new features and hopefully makes you more efficient. To get the most from these improvements, you need 486 processing power. Until now, your only solution was to buy a whole new system. In addition to the cost, this meant re-installing software and buying new peripherals.



Don't Replace the System – Simply Upgrade the Processor.

A better alternative is to upgrade only the processor. 486/Now! from Kingston is a great way to get the processing power you need for business applications, network file



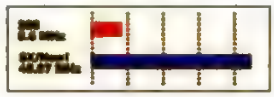
servers, graphics programs and CAD/CAM. 486/Now! is available with either a 486DX 33MHz or a 486SX 25MHz, and has an on-board clock for optimum processor performance.

The Solution For 286 Systems.

SX/Now! is a great way to upgrade 286 systems from IBM, Compaq, AST, HP, Epson, NEC, Toshiba and Zenith to a Windows and OS/2 ready Am386SX, the fastest 386SX available. SX/Now! features 16kb of fast cache memory, supports a 387SX co-processor and has an on-board clock.

Easy Installation, Compatibility, Unquestioned Reliability.

Kingston processor upgrades plug directly into the system board, won't



interfere with bus slots and take only about ten minutes to install. They're guaranteed fully compatible with both the systems for which they were designed, plus all popular operating systems and applications. 486/Now! and SX/Now! carry five-year warranties. For the power you need and the reliability you expect, call Kingston at (800) 835-6575 for more information or the name of a reseller near you.

Comparison of native Compaq Deskpro 386/20e and same system with 486/Now! 486DX-33MHz Landmark Speed Test 2.02. Comparison of native IBM PS/2 Model 50 and same system with SX/Now! 386SX-33MHz Landmark Speed Test 2.03. All trademarks are of their respective owners.

Kingston TECHNOLOGY CORPORATION

THE INSIDE NAME IN UPGRADES

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1-year onsite warranty[1]

Service response time: 4 hours on average[2]

800# assistance–7 days a week, 24 hours a day

30-day money-back guarantee[1]

Configuration pictured

386SLC™/25 MHz

80MB hard drive
2MB RAM
PS/2® 8511–VGA
5 slots, 5 bays & mouse
DOS 5.0 pre-installed

$1,299*

486 SX/25 MHz

80/170MB hard drive
8MB RAM
PS/ValuePoint 6312–SVGA
5 slots, 5 bays & mouse
OS/2® 2.0 pre-installed

$1,629* 80MB
$1,849* 170MB

386SLC/25 MHz

170MB hard drive
4MB RAM
PS/ValuePoint 6312–SVGA
5 slots, 5 bays & mouse
DOS 5.0 pre-installed

$1,599*

intel inside

*Warranty and 30-day guarantee information available from IBM and IBM-authorized dealers. [1]Available Monday through Friday, 8 a.m.–5 p.m. in your time zone, when serviced by IBM or IBM Authorized Personal Systems Servicers. Applies to IBM direct sales only. *IBM prices only. IBM, OS/2 and PS/2 are registered trademarks and PS/ValuePoint, ThinkPad, HelpWare and 386SLC are trademarks of International Business Machines Corporation. The Intel Inside Logo is a trademark of Intel Corporation. ©1992 IBM Corporation.*

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The PS/ValuePoint line features a range of 386 to 486 processors, 80 to 170MB hard drives and standard 2 to 8MB RAM. And each system is easily expandable and ready to network. So it keeps your costs down and protects the investments you've already made.

Plus, every PS/ValuePoint comes with IBM HelpWare,™ our comprehensive service and support plan that's unmatched in the industry.

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two new lines.

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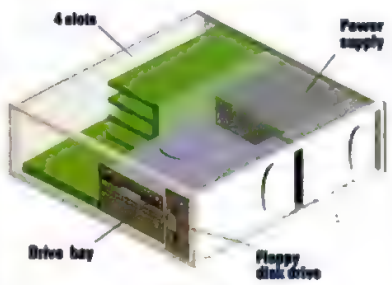
FACT FILE

AcerPower 386/SX

Acer America Corp., 2641 Orchard Pkwy., San Jose, CA 95134; 800-733-2237, 408-432-6200; fax, 408-432-6221

List price (tested configuration): 386SX/25, $1,293; 486SX/25 upgrade, $130; 486DX2/50 upgrade, $642.
Memory and processor RAM cache: 8MB 80-ns SIMMs.
Disk drives and controller: 212MB Conner CP30204F IDE hard disk with a 64K buffer, 1.2MB and 1.44MB floppy disk drives.
Display: Acer motherboard video subsystem with an ATI chip set and 512K video DRAM; AcerView 33D 14-inch Super VGA monitor, 56-Hz refresh rate at 800-by-600.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The AcerPower 386/SX has come down in price, but its construction is a bit flimsy.
491 ON READER SERVICE CARD



style mouse connectors. Three bays (two 5.25-inch and one 3.5-inch) are accessible; one 3.5-inch bay is internal.

Our test unit came with 8MB of RAM and a 212MB Conner IDE hard disk with a 64K buffer. Acer uses its own motherboard, which integrates not only the video and I/O but disk controller circuitry as well. The four 16-bit expansion slots are mounted vertically in the center of the unit. Acer included a 14-inch AcerView monitor with front-mounted analog controls and a previous-generation Logitech two-button mouse.

Upgrading is fairly straightforward. A standard 486 socket lets you upgrade directly on the motherboard. Both the 386 and 486 sockets are easily accessible, as are the memory banks, but you still have to remove all full-length expansion cards to upgrade either. Though most of the system jumper settings are accessible, you will need to pull out the external drive bays to reach a few. There is no socket for a Weitek math coprocessor and no support for an external processor RAM cache. The documentation was professionally prepared and somewhat technical, but it was not impossible to follow.

We tested the AcerPower 386/SX with 386SX/25, 486SX/25, and 486DX2/50 processors. Its processor, memory, and disk test scores were below the average. Its processor scores were hurt by the lack of a secondary cache.

Acer also manufactures an EISA-based AcerPower 500/33 that you can upgrade via proprietary processor plug-in cards; it runs with a wide, 128-bit memory bus and starts with the 486DX/33 processor platform. Acer chose not to send it for this review, because it is specialized for the high-end server or CAD workstation market. Acer backs its products with a one-year warranty on parts and labor and offers on-site service the first year.—*Oliver Rist*

Acer America Corp.

AcerPower 486/SX

Though part of the AcerPower family, the AcerPower 486/SX uses a different motherboard than its 386 sibling. Of this $2,339 486SX/20's flaws, the most glaring is a poor case construction.

The inside is no better: The drive bay assembly was so loose that it repeatedly fell out onto the motherboard during CPU installations. That aside, the standard small-footprint case holds one external 5.25-inch, one external 3.5-inch, and one internal 3.5-inch drive bay, all of which were occupied. The reset, power, and turbo switches are front-mounted, as are the keyboard and PS/2 mouse connectors.

The AcerPower 486/SX

Acer America Corp.'s 486SX ChipUp motherboard uses an Acer system BIOS and holds between 2MB and 98MB of 80-nanosecond RAM. Our test unit had 8MB of RAM, a 256K cache, and integrated I/O ports, drive controller, and video circuitry. The latter runs off the I/O bus; the system uses ATI chips and has 1MB of DRAM. Though you can run the drives off the system board as well, the model Acer sent us had a 2MB UltraStor IDE cached controller connected to a 212MB Conner IDE hard disk, which used its own internal 64K track buffer. The 14-inch AcerView monitor displays up to 1,024-by-768 interlaced.

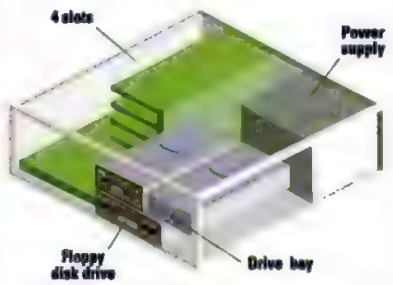
You need a chip puller to upgrade the motherboard, a screwdriver for the drive

FACT FILE

AcerPower 486/SX

Acer America Corp., 2641 Orchard Pkwy., San Jose, CA 95134; 800-733-2237, 408-432-6200; fax, 408-432-6221

List price (tested configuration): 486SX/20, $2,339; 486SX/25 upgrade, $130; 486DX/33 upgrade, $425; 486DX2/50 upgrade, $642.
Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K external SRAM cache.
Disk drives and controller: 212MB Conner CP30204F IDE hard disk with a 64K buffer, UltraStor 15C hard disk controller card with 2MB cache 1.2MB and 1.44MB floppy disk drives.
Display: Acer motherboard video subsystem with an ATI 28800 chip set and 1MB video DRAM; AcerView 14-inch 33D Super VGA monitor, 56-Hz refresh rate at 800-by-600.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: Acer America Corp. has reduced the price of its AcerPower 486/SX, but this PC still falls short of many competitors.
492 ON READER SERVICE CARD



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Complete Network has Intel® EtherExpress16™ LAN Adapters for your network connections. Installation is easy because the cards are totally software configurable and automatically adjust for 8 or 16 BIT card slots. These *Plug 'N' Forget*™ cards from Intel set the standards for Ethernet LAN adapters.

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Complete Network features the WEB® 3.0 Network Operating System, winner of the LAN Times 1992 *Best of Times* award. WEB 3.0 is a fast and flexible system which is simple to learn and easy to use. It supports DOS and Windows™ and is Novell® compatible. WEB 3.0 provides the first peer-to-peer network to equal or exceed the performance of most dedicated server based systems.

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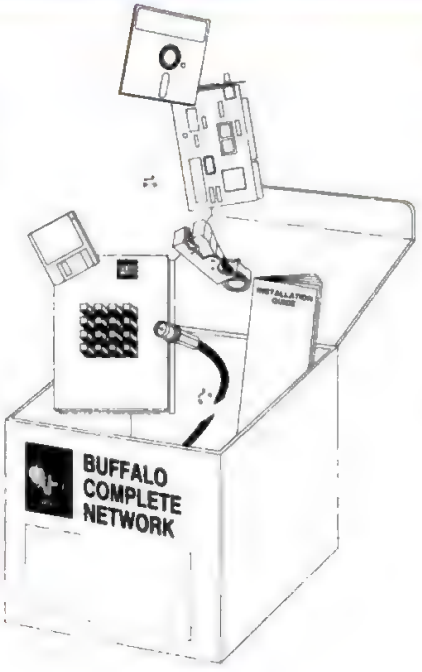

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bays, and pointy fingernails for setting some alternate jumper configurations. Acer's manual is decent but leaves out some of the more technical information an experienced user might require: Documentation concerning jumpers P101 and P102 was conspicuously absent. Since these control the CPU clock speed, you can imagine they might be of interest when you want to upgrade the processor.

We tested the AcerPower 486/SX with a 486SX/20, 486SX/25, 486DX/33, and 486DX2/50 processor. Processor and memory test scores were average or better, probably due to the 256K external cache. The integrated video managed standard performance across the Windows and DOS platforms.

Acer's warranty covers one year on parts and labor; on-site from Intelogic-Trace is free the first year.—*OR*

Advanced Logic Research Inc.

ALR Flyer 32DT

Like all the ALR models, the ALR Flyer 32DT has been designed with upgrading in mind. But in the Flyer 32DT, Advanced Logic Research gives you more than just an easy though somewhat expensive route to a more powerful PC. This slimline is actually a midrange desktop unit with a 32-bit data path between the CPU, RAM, and external cache.

The $3,095 base-priced model came to us with a 486SX/25 processor, 8MB of RAM (36MB is the maximum), a Maxtor 211MB hard disk plus an UltraStor caching controller with 512K of RAM, a Western Digital Paradise video card with 1MB of RAM, and a 14-inch monitor.

You couldn't ask for an easier upgrade. It took our lab technician 5 minutes to install the new CPU card; it may take a novice a couple more. The system automatically senses the new processor and adjusts its parameters appropriately.

We tested the Flyer 32DT with a 486SX/25, 486DX/33, and 486DX2/50 processor. Possibly due to the lack of an external processor cache, the PC's processor scores were slightly below the average. On the other hand, the 486DX/33 version turned in an impressive score, and the 486DX2/50 led the pack with its memory test score.

The Flyer 32DT also had plenty of

The ALR Flyer 32DT

room for expansion. In addition to the expected three drive bays and four 16-bit ISA slots, the Flyer 32DT had two 32-bit proprietary slots, one for the upgrade CPU card and the other for a cache card; The 16-bit slots can accommodate a SCSI controller or other options.

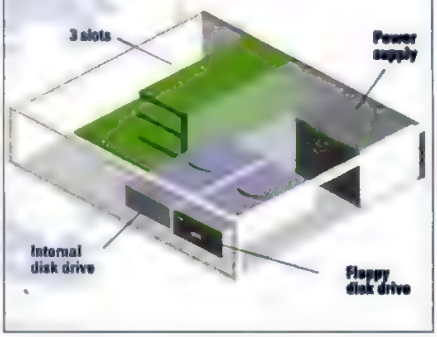
Because the integrated motherboard contains video, I/O, and an IDE hard disk controller, the ALR motherboard didn't need the optional video adapter or UltraStor 15C controller that ALR chose to include. The UltraStor product caused us some problems. Before we could install our tests, we had to debug it and turn off the deferred write, a performance option that is turned off in most systems using this card.

The documentation, while not very extensive, should be enough for most users. ALR offers a one-year parts-and-labor warranty, and the first year of on-site service costs only $9.95.
—*William P. Flanagan*

FACT FILE

ALR Flyer 32DT
Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; 800-444-4257, 714-581-6770; fax, 714-581-9240

List price (tested configuration): 486SX/25, $3,095; 486/33 upgrade, $1,095; 486DX2/50 upgrade, $1,395. Rebates from $100 to $200 apply to various upgrades.
Memory and processor RAM cache: 8MB 70-ns SIMMs.
Disk drives and controller: Maxtor 16-ms 7213AT 211MB IDE hard disk, UltraStor 15C caching disk controller with 512K cache, 1.44MB floppy disk drive.
Display: Western Digital Paradise video adapter with 1MB RAM, ALR FlexView 3X 14-inch monitor, 76-Hz refresh rate at 800-by-600.
In short: The ALR Flyer 32DT has a very easy upgrade path but is somewhat expensive.
493 ON READER SERVICE CARD



Advanced Logic Research Inc.

ALR Flyer 32LCT

Advanced Logic Research shows how easy—and expensive—upgrading can be: Just take out the CPU card and replace it with the new one, and your system automatically senses the new processor and makes the necessary adjustments. The company has positioned its ALR Flyer 32LCT, an ISA tower with a 32-bit data path between the processor, system memory, and external cache, for the low to midrange server market.

Our test unit, priced at $3,823, came to PC Magazine Labs with a 486SX/25 processor, no external cache, a Maxtor hard disk with an UltraStor caching controller, and 8MB of RAM. The system can accommodate up to 64MB on the motherboard, along with an additional 64MB on an expansion card. Video is based on a Western Digital Paradise graphics adapter that held 512K of DRAM, and the same ALR 14-inch monitor included with the other two ALR machines we reviewed for this story.

On our processor test, the uncached

The ALR Flyer 32LCT

DO SOMETHING™

NEW BREED

DO SOMETHING

486SX/33—$1999

This Hyundai 486SX-33 can out-muscle those barnyard bovines of cow country. But you be the judge.

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- 32-bit VESA local bus UVGA graphics w/1MB VRAM
- 128KB "warpspeed" write-back 20ns SRAM L2 cache (expandable to 256KB)
- Upgradable to 486DX power via Intel Overdrive™ socket
- 4MB system memory expandable to 64MB on system board
- 120MB 19ms IDE HDD, 32KB disk buffer
- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs, (2.88MB-ready FDD interface)
- 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt and swivel base
- 2S/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 expansion slots, including 1 VESA local bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
- Built-in virus protection, front keylock, 2 level password
- MS DOS 5.0 and MS Windows 3.1

Hyundai 433S

Want to talk add-ins? We test our 486 systems with literally hundreds of industry-standard cards and software applications. We test software compatibility on Novell (we're fully certified and a Novell Alliance Program member), Banyan Vines, OS/2 2.0, LAN Manager, and SCO UNIX, plus hundreds of programs running under Windows and MS DOS.

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intel inside

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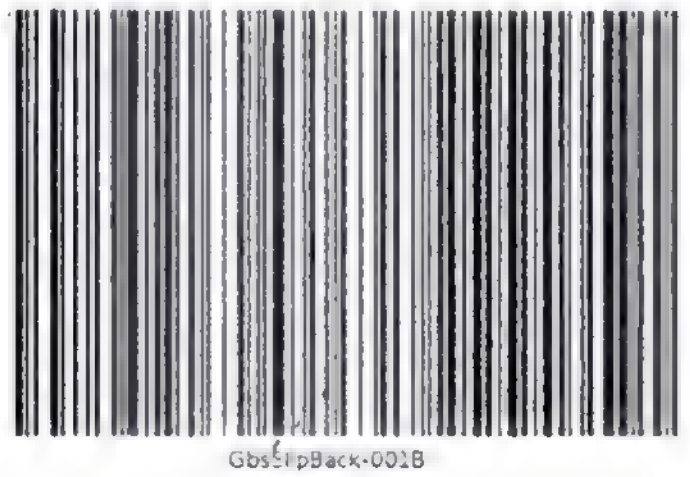

Back

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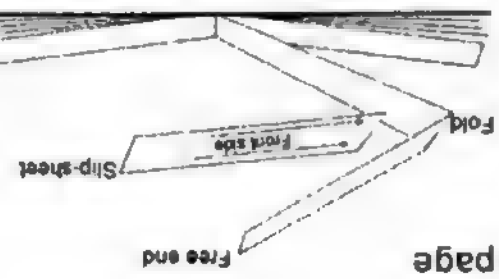

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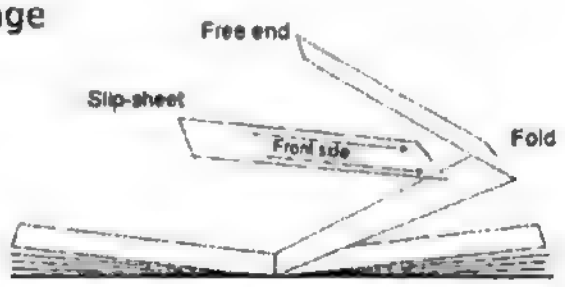
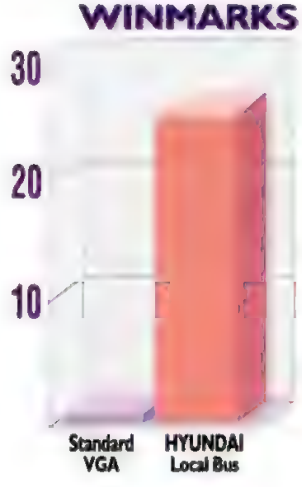


DO SOMETHING

486 STAMPEDE

That thunder you hear on the PC prairie is the New Breed Hyundai 486 stampede. The hardest-charging, price-lean, MIPS-mean herd of computers you'll ever see. We're bringing everything from powerful 66MHz 486DX2 machines to Overdrive-Upgradable 486SX-25 computers. And with our 50MHz 486DX2 desktop PC and 486DX-33 blasters, you can handle today's demanding applications.



Do something "Longhorn" Local Bus.

That flash you see on the graphics horizon is the image of our Windows processing power triggering the Hyundai 486 stampede.

Your 486 processor was meant to run today's applications. So why rein in all that power? That out-to-pasture, 16-bit VGA card can only deliver 2 Megapixels at best. That's already dated technology. Let her rip with 32-no-blink-bits of "Longhorn" *Local Bus video acceleration.* And with up to 32 Megapixels *standard*, believe it, you'll see an incredible difference in Windows performance.

Do something thunderbolt.

Lightning-fast *"warpspeed" L2 caching* is another max-performance feature that's designed into every Hyundai 486. Thunderbolt write-back operations blast your DOS, Windows, or OS/2 data into a box canyon of ultra-fast SRAM. Start out with 128KB standard (more than the cow computers), then expand to 256KB to handle today's big applications. Cache hit for cache hit, the Hyundai 486 Family, with 128KB standard caching, delivers twice the MIPS of non-cached cows.

Do something upgradable.

The Hyundai 486 New Breed Family is designed in Silicon Valley, U.S.A., to out-perform the herd.

All of our systems are *CPU-upgradable* through a single chip via a *ZIF or Overdrive socket*, so the New Breed lets you double your speed. We won't let tomorrow's 32-bit operating systems blast a hole in your productivity. Just upgrade your Hyundai 486 to any higher-speed Intel 486 CPU in the future.

AND PUT THE OLD BREED OUT TO PASTURE.

Every cow has its day. But it's time to put that milker out to pasture and make way for the Hyundai 486 stampede. It's time to Do Something New Breed®.

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And with up to 32 *Winmarks* of Windows processing power, Hyundai's bulletproof, 32-bit 486 Systems are designed and engineered for your high-throughput applications. For instance, *Local Bus Graphics are standard* on every system, from our entry-level computers up through our top-of-the-line desktops. You'll tear through Windows with our razor-sharp, 32-bit processing. Plus, up to 32 Megapixels of mind-bending *GUI acceleration is standard* with every New Breed 486 from Hyundai. And here's more New Breed value engineering. Our expandable,"warpspeed" *L2 cache architecture is standard* on every Hyundai 486 system.

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HEAD TO HEAD

Hyundai 425SP
New Breed Power
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i486SX-25 SYSTEM WITH NEW BREED POWER	HYUNDAI	GATEWAY
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–15 Plus Winmarks of GUI Performance	YES	NO
–Motherboard Video w/1 MB VRAM	YES	NO
• 486 Level 2 Caching	YES	NO
–128KB Standard	YES	NO
–256KB Maximum Expansion	YES	NO
• 11 MIPS Max-Throughput	YES	NO
• Intel "Overdrive" Upgrade Socket	YES	NO

• 4MB system memory expandable to 64MB on system board • 120MB 19ms IDE HDD, 32KB disk buffer • 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs • 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution,tilt and swivel base • 2S/1P, integrated PS/2 mouse port • 4 external drive bays • 5 expansion slots • 200 watt power supply • 101 keyboard, 2 button mouse • Built-in virus protection, front keylock, 2 level password • MS DOS 5.0 and MS Windows 3.1 • Optional cost: Full-Profile Chassis with 32-bit VESA local bus graphics. Call us. System shown with optional hardware.

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- 2S/1P, Integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 slots incl. 1 VESA local bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
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- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs
- SVGA graphics card
- 14" interlaced, ultra-high resolution, flicker-free, color display with 1024 x 768 resolution, .28 dot pitch, 72MHz refresh rate
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Floppies	❑ 1.44MB 3-1/2"	❑ 1.2MB 5-1/4"				
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test unit was a below-average performer at all processor levels: 486SX/33, 486DX2/50, and 486DX2/66. The unit's memory test scores were average across the board. Its disk performance was average, as were its DOS video test scores; its Graphics Winmark results placed this machine below the average.

ALR uses its own motherboard, which integrates the I/O, video, and IDE hard disk electronics; the unit also included an UltraStor caching disk controller. Below the six 5.25-inch and four low-profile 3.5-inch drive bays are ten 16-bit expansion slots. One was filled, leaving nine empty. Two 32-bit proprietary slots hold the processor card and an optional external cache. Though the motherboard is easily accessible, two 3.5-inch drive bays hang low enough to block access to the SIMM banks.

The documentation for this system is not very extensive, but it should satisfy most users. Beginners will be able to benefit from its tutorial approach. ALR offers a one-year parts-and-labor warranty, and the first year of on-site service costs $9.95 for second-day response. More coverage from ALR costs extra.—*WPF*

FACT FILE

ALR Flyer 32LCT

Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; 800-444-4257, 714-581-6770; 714-581-9240

List price (tested configuration): 486SX/25, $3,823; 486/33 upgrade, $1,095; 486DX2/50 upgrade, $1,395; DX2/66 upgrade, 1,395. Rebates from $100 to $200 apply to various upgrades.

Memory and processor RAM cache: 8MB 70-ns SIMMs.

Disk drives and controller: Maxtor LXT340A 325MB IDE hard disk, UltraStor 15C caching disk controller with 1MB DRAM, 1.44MB floppy disk drive.

Display: Western Digital Paradise video adapter with 512K RAM, ALR FlexView 3X 14-inch monitor, 76-Hz refresh rate at 800-by-600.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The ALR Flyer 32LCT EISA tower offers good expansion and is easily upgradable, but its price may be an obstacle for some.

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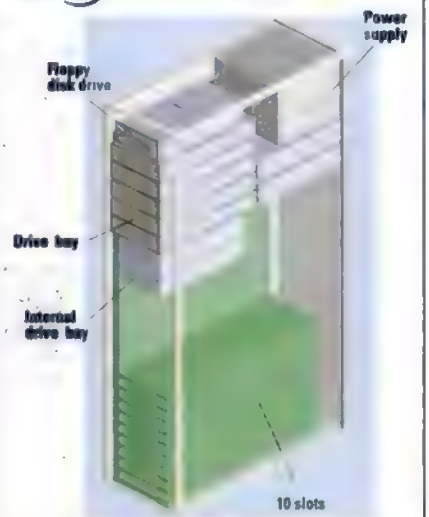


Advanced Logic Research Inc.

ALR PowerFlex Flyer

Although both the ALR PowerFlex Flyer and the ALR Flyer 32DT are slimlines, Advanced Logic Research has priced the PowerFlex as a lower-end machine. Several design decisions allow it to reach its $3,134 price with a 486SX/25 CPU, but the tradeoff is this computer's disappointing processor, memory, and video performance.

ALR uses its own motherboards, which contain fully integrated disk controller, I/O ports, and video graphics adapter. The PowerFlex has five expansion slots: three 16-bit ISA and two proprietary slots, one of which is taken up by the CPU card. Unfortunately, it lacks both a third slot (which would be used for a processor RAM cache) and a 32-bit data path between the CPU, RAM, and cache; the Flyer 32DT design includes all of these.

We tested the PowerFlex with a 486SX/20 and a 486SX/25. The 486SX/20 system lagged behind the other competitors in most categories, and achieved the lowest score in the processor, Windows video and overall DOS categories. In most areas, the 486SX/25 version redeemed the ALR PowerFlex, yet it came in last in terms of its Graphics Winmark results.

The PowerFlex costs $2,535 for a 386SX/25 with 8MB of RAM (the system maximum is 16MB), a Maxtor 204MB hard disk, and an ALR 14-inch monitor. DOS 5.0 and Microsoft Windows 3.1 were preinstalled.

You have to love ALR's easy upgrades: Just insert the new card and the system does the rest. After a rebate for returning the original board, the upgrade costs $449 for a 486SX/20 and $549 for a 486SX/25.

The ALR PowerFlex Flyer

The documentation is a collection of component manuals, but a clear and comprehensive user manual helps both experts and average users. ALR offers a standard one-year parts-and-labor warranty; its on-site service costs $9.95 the first year.—*WPF*

FACT FILE

ALR PowerFlex Flyer

Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; 800-444-4257, 714-581-6770; fax, 714-581-9240

List price (tested configuration): 386SX/25, $2,535; 486SX/20 upgrade, $499; 486SX/25 upgrade, $599. Rebates from $50 to $100 apply to various upgrades.

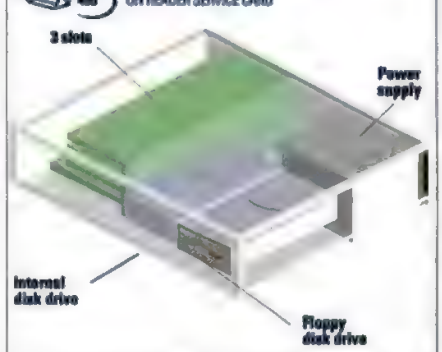
Memory and processor RAM cache: 8MB 80-ns SIMMs.

Disk drives and controller: Maxtor 7213AT 204MB IDE hard disk, 1.44MB floppy disk drive.

Display: Integrated video controller with 512K DRAM, ALR FlexView 3X 14-inch monitor, 76-Hz refresh rate at 800-by-600.

In short: Easy upgradability does not offset limited expansion and expensive upgrade parts.

496 ON READER SERVICE CARD



Ariel Design Inc.

Ariel 486SX/25

The $2,290 Ariel 486SX/25 has a stellar past: it won an Editors' Choice award in our last roundup of 486SX/25 systems (October 13, 1992) and received an honorable mention in our 486DX2/50 PC story (September 15, 1992). Because we brought back the Editors' Choice winners and honorable-mention machines from these two stories, the Ariel has earned itself a place in this upgradable PC story.

The Ariel's only upgrade path is the OverDrive chip, which makes moving up to a 50-MHz processor fairly straightforward and easy. Once the chip was installed, the system worked well, and had no technical problems. Performance for the base 486SX/25 system and the 50-MHz OverDrive upgrade, were however, below the average in each group. This was particularly the case in terms of its memory test scores (even with its 256K external cache). Its disk performance score was the lowest under DOS and average under Windows. Video was average across both platforms as well. The bright spot was the Ariel's score in the processor test, where it was in the top five in the 486SX/25 group. For a complete review, see the October 13 issue.

Ariel backs this system with free on-site service from TRW and a one-year parts-and-labor warranty.—*OR*

The Ariel 486SX/25

FACT FILE

Ariel 486SX/25

Ariel Design Inc., 145 Webster St., Hanover, MA 02339; 800-882-7435, 617-982-8800; fax, 617-982-9095

List price (tested configuration): 486SX/25, $2,290; 486DX2/50 upgrade, $550.

Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K cache.

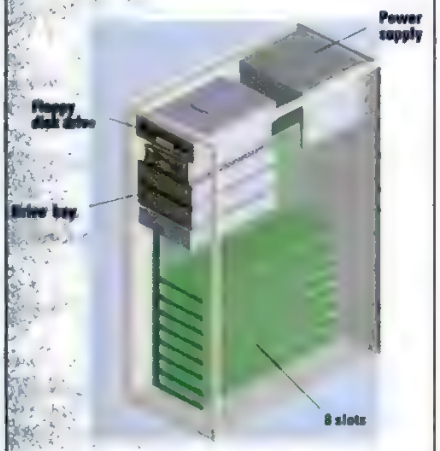
Disk drives and controller: Quantum ProDrive LPS 240AT 245MB IDE hard disk with internal 256K cache, DFI controller, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond Stealth VRAM with an S3 accelerator and 1MB of VRAM, ViewSonic 6 monitor, 60-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Ariel 486SX/25 won an Editors' Choice award for its performance in our story of October 13, 1992. As an upgradable, its options are limited.

ON READER SERVICE CARD



AST Research Inc.

AST Power Premium

If you like easy upgrades, the AST Power Premium is certainly worth a look. With its Cupid-32 expansion cards,the Power Premium is a well-designed EISA-based unit with processor options ranging from 386SX/25 to 486DX2/50 and prices ranging from $2,940 to $4,335.

This small-footprint desktop PC has a 3.5-inch floppy disk drive mounted in one of its two 5.25-inch front-accessible half-height bays. A front-accessible one-third-height bay and two internal 3.5-inch half-height bays are also included.

The Power Premium's EISA motherboard offers a parallel port, two serial ports, and a PS/2-style mouse port. Its Western Digital 90C31 video chip set has 1MB of DRAM and handles resolutions up to 1,024-by-768. The disk controller is connected to a 244MB Quantum ProDrive LPS IDE hard disk with an internal 256K cache.

Called Cupid-32, the full-length 32-bit processor upgrade expansion cards also hold system RAM (2MB standard for the 386SX/25 and 386DX/25 models, 4MB for the 386DX/33 to 486SX/25 models, and 8MB for higher-level processors) and an OverDrive socket, giving the owner several upgrade choices. The only downside of this well-thought-out design is that as the case gets crowded with expansion boards, ventilation suffers; a heat sink might be a good idea for higher processor levels.

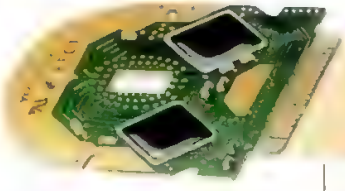
Three of the six EISA expansion slots have Cupid-32 proprietary extensions to accommodate the processor card and up to 80MB of RAM. AST Research's flash BIOS implementation allows for simple software BIOS upgrades. Monitor options range from the $365 14-inch AST Super VGA monitor to the $1,295 17-inch AST Super VGA Color. Our test system shipped with 8MB of system RAM, DOS 5.0, Microsoft Windows 3.1, and a PS/2-style mouse.

ZD Labs tested the Power Premium on the 386DX/33, 486SX/25, 486DX/33, and 486DX2/50 processor platforms. Its memory and video test scores were average across all processor levels, although the PC turned in a subpar disk result. The bright spot in testing came when we looked at the processors' performance, which was consistently near the top of each processor class.

AST offers a standard one-year parts-and-labor warranty. Customers within 50 miles of an AST service center qualify for on-site service. Fax- and BBS-based support is also available. Two new members of the Power Premium family—the Intel 486SX/33-based Model 4/33s (priced

The AST Power Premium

OKIDATA'S NEW PRINTER: WE COULDN'T MAKE IT STRONGER SO WE MADE IT SMARTER.



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CIRCLE 235 ON READER SERVICE CARD

FACT FILE

AST Power Premium

AST Research Inc., 16215 Alton Pkwy., Irvine, CA 92713-9658; 800-876-4278, 714-727-4141; fax, 714-727-9355

List price (tested configuration): 386SX/25, $2,940 (without Windows); 386DX/25, $2,895 (without Windows); 386DX/33 upgrade, $795; 486SX/25 upgrade, $745; 486DX/33 upgrade, $1,095; 486DX2/50 upgrade, $1,395.

Memory and processor RAM cache: 8MB 70-ns SIMMs.

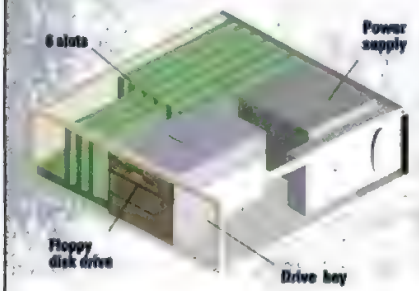
Disk drives and controller: Quantum ProDrive LPS 244MB IDE hard disk with internal 256K cache, integrated controller, 1.44MB floppy disk drive.

Display: AST motherboard video subsystem with Western Digital WD90C31 chip set and 1MB video DRAM; AST SuperVGA LR14 monitor, 60-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0.

In short: The EISA AST Power Premium is a well-designed machine with extremely easy processor upgrades. Its price may not be the lowest, but it is still competitive and worth a close look.

ON READER SERVICE CARD



from $2,195 to $3,095) and the DX2/66-based Model 4/66d (from $3,195 to $3,895)—shipped too late for us to review them.—*OR*

Atlas Industries Inc.

Atlas ProNet 486UX Series

Though the $2,850 DX/50 Atlas ProNet 486UX Series offers better than average performance, its upgrade path was not well-planned. You need a chip puller and a screwdriver—the latter to disassemble the lower drive bay. If you are looking for easy upgrades, this is a difficult recommendation.

The standard-size tower case is flexible rather than sturdy, and it holds six accessible and two internal drive bays. The NiceUSA motherboard uses an ETEQ chip set and AMI system BIOS. Onboard memory ranges from 1MB to 32MB (expandable to 64MB with an optional 32-bit memory expansion card). An ETEQ direct-mapped write-through external cache comes in sizes from 64K to 256K. The system's 212MB Conner IDE hard disk uses a SuperIDE pass-through controller with a 2MB cache. Video is handled by an Orchid Fahrenheit 1280° card with 1MB of video RAM. The 14-inch CTX monitor we tested was unremarkable. Four of the seven 16-bit expansion slots are empty, but one can't accept full-size cards. I/O ports reside on a vanilla 8-bit expansion card instead of on the motherboard—apparently a cost consideration by Atlas Industries.

Switching processors in the Atlas proved to be difficult at best. A standard processor socket is mounted on the motherboard, but it is so inaccessible that you will first want to disassemble and remove the lower drive bay assembly. Unfortunately, this procedure includes disconnecting the hard disk *and* the 3.5-inch floppy disk drive, which is mounted two bays below the 5.25-inch floppy disk drive; Mounting the drive directly beneath, as on most systems, would have eliminated the necessity of this task. The clock crystal occupies an upgradable oscillator socket, but it fits loosely, and jostling can break the crystal free, rendering the system inoperable.

Configuring six jumper switches prior to starting the system turns out to be a fairly simple task, due to a large and understandable table. Unfortunately, this table and a small (and slightly redundant) diagram of the motherboard make up the manual. Even with such limited explanation, Atlas managed to print two different settings for the SX chip on pages one and two.

The Atlas ProNet 486UX Series

Across the 486SX/25, 486DX/33, 486DX2/50, and 486DX/50 processor platforms, the Atlas managed less than average performance on our memory benchmark test. Its video performance was average.

Atlas ships the 486 Series with a standard one-year parts-and-labor warranty. A one-year on-site service contract is available through US Onsite for $50.—*OR*

FACT FILE

Atlas ProNet 486UX Series

Atlas Industries Inc., 6405 Independence Ave., Woodland Hills, CA 91367; 800-285-2711, 818-710-1980; fax, 818-710-0368

List price (tested configuration): 486SX/25, $2,435; 486DX/33 upgrade, $265; 486DX/50 upgrade, $415; 486DX2/50 upgrade, $315.

Memory and processor RAM cache: 8MB 50-ns SIMMs.

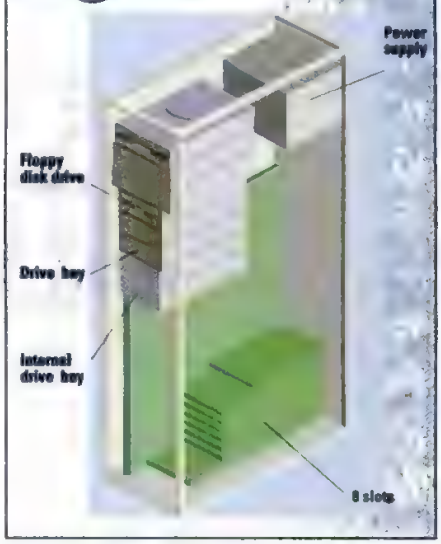
Disk drives and controller: Conner CP30204 212MB IDE hard disk, SuperIDE DC-99M IDE disk controller with a 2MB cache, 1.2MB and 1.44MB floppy disk drives.

Display: Orchid Fahrenheit 1280 video card with 1MB of VRAM, CTX CVP5468 14-inch monitor, 70-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Atlas ProNet 486UX Series is an average system in terms of price and performance, with a difficult processor upgrade path.

ON READER SERVICE CARD



To anyone who has ever dreamed that personal computing could be even easier than it is today.

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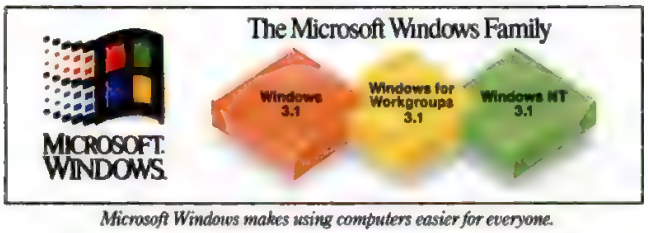

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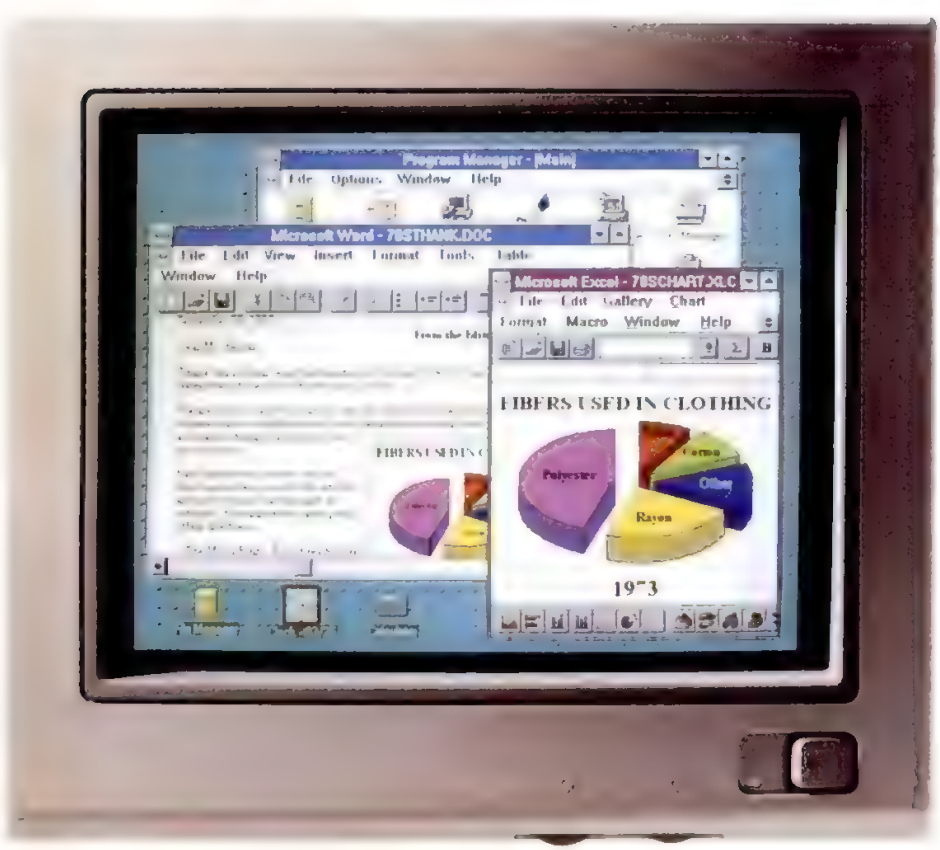
Windows for Workgroups lets people work together through built-in electronic mail, file sharing, printer sharing and scheduling.



If you're a developer, you can get a copy of the Win32 Preliminary SDK for Windows NT by calling Microsoft Developer Services at (800) 227-4679. © 1992 Microsoft Corporation. All rights reserved. Printed in the USA. Inside the 50 United States, call

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It's based on the idea th
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nount of give and take.

As anyone in business would tell you, success often depends on how well you can work with others.

Not coincidentally, this is the strength of the Microsoft® Windows™ for Workgroups 3.1 operating system.

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The file manager toolbar lets you use your network as fast as you can point and click. It gives you access to commonly used functions, such as sharing files and sending documents, at the touch of a button. How could sharing information be any easier?

For starters, you can say goodbye to the old "mind if I borrow your disk" routine. With Windows for Workgroups, you'll be able to share files and applications, even printers, faster than you can say "eject."

And then there's this handy little feature called Schedule+.

Say you want a meeting on Tuesday with Matt, who has a meeting with Duncan and Karen, who, wouldn't you know it, are meeting with Jim that same day.

No problem.

Just a couple of clicks and, zip, everyone's schedules are laid out right in front of you. So you can book a meeting without making a jillion phone calls.

Even things as basic as sending memos are simplified with Microsoft Windows for Workgroups. Now you can send electronic mail, including voice and graphics, to anyone in your workgroup.

In other words, Windows for Workgroups lets you share something with your coworkers other than frustration.

But just because it has these advanced capabilities doesn't mean that you'll need an advanced degree to understand it.

Quite the contrary.

Microsoft Windows for Workgroups is based on the familiar interface that millions of people have come to love. Even if you've never used Windows, it's the ideal starter network.

And since it works with Windows-based and MS-DOS® applications just like Windows 3.1, you can preserve and build on any investment you make in Windows.

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ATronics International Inc.

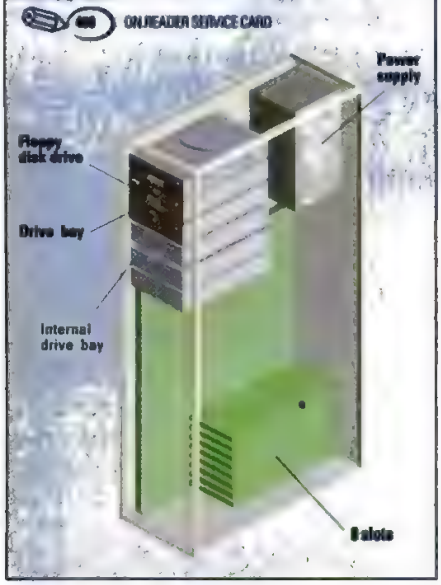
ATronics ATI-B2 Series

ATronics International's $1,760 SX/20 PC, the ATronics ATI-B2 Series is priced well, but its design focus seems scattered. The huge ISA tower case hints at duties beyond those of a simple desktop workstation, yet the system's components and performance are more in line with that of much smaller machines. And as an upgradable computer, the ATI-B2 didn't quite crash and burn, but it also didn't soar.

FACT FILE

ATronics ATI-B2 Series
ATronics International Inc., 45635 Northport Loop East, Fremont, CA 94538; 800-488-7776, 510-656-8400; fax, 510-656-8560

List price (tested configuration): 486SX/20, $1,760; 486SX/25 upgrade, $22; 486DX/33 upgrade, $295; 486DX2/50 upgrade, $395; 486DX/50 upgrade, $435.
Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Maxtor 7213AT 213MB IDE removable hard disk with internal 64K buffer, ATI controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond Stealth VRAM video adapter with an S3 GUI accelerator and 1MB of video memory, ViewSonic 5+ 14-inch monitor, 70-Hz refresh rate at 800-by-600.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The ATronics ATI-B2 Series is an average performer, and a novice would likely have trouble with the upgrade.



The case's upright design comfortably surrounds two internal and six accessible 5.25-inch bays. Three of the latter hold the 3.5-inch and 5.25-inch floppy disk drives and a removable hard disk. The machine's healthy 250-watt power supply pumps juice to the system; the outside has an aesthetically pleasing design, with the power, reset, and turbo switches large and front-mounted.

The ATronics ATI-B2 Series

ATronic's own 486/B2 motherboard rests inside and is controlled by a UMC chip set with an AMI system BIOS. Seven 16-bit slots and one 8-bit slot are located at the rear of the case. I/O is handled from an 8-bit card, which unfortunately wires the excess ports into the neighboring slot's rear retaining bracket; you will have to rewire them out the back of the computer if you want to use the slot.

Our test unit held 8MB of RAM (64MB is the maximum); memory can be buffered by an external cache that can hold from 32K to 256K (our test unit came with 256K). The Maxtor 213MB IDE hard disk had an internal 64K buffer; a handle on the hard disk's front lets you take it with you. The ATI-B2's controller is from ATI.

Video is handled by a Diamond Stealth VRAM with an S3 GUI accelerator, 1MB of video memory, and a 14-inch ViewSonic monitor. Microsoft Windows 3.1and DOS 5.0 accompany the unit, as does a BTC Cutie mouse that handles 230 points per inch.

While upgrading the ATI-B2 isn't a nightmare, this procedure probably is not the best for a novice to try. The tower case's large size allows for fair accessibility to all the relevant areas of the motherboard. (Some less dexterous users may first want to remove the lower drive bay assembly first, which is a simple procedure.)

You will need a chip puller to get the processor out of its socket, and you will also need to replace the clock crystal. The crystal fits loosely in its socket, so you won't want to tie it down; should the crystal fall out, you will have to open everything up again and search for it. The documentation was fairly complete but poorly organized; it was certainly not prepared with PC newcomers in mind.

We tested the ATI-B2 with a 486SX/20, 486SX/25, 486DX/33, 486DX2/50, and 486DX/50 processor. Though its processor benchmark test scores were generally average, its Diamond Stealth video card lagged in DOS and excelled on our Graphics Winmark and Disk Winmark tests; the unit's scores on our memory and disk benchmark tests were either a little above or a little below the mean for this story.

ATronics supports its ATI-B2 with a one-year warranty that covers parts and labor; on-site service from Nationwide Warranty Corp. will cost you an extra $99. Technical support is handled only during business hours and via a standard toll telephone line.—*OR*

Axik Computer Inc.

Axik Ace Cache 486ALL! Series

The Axik Ace Cache 486ALL! Series spans the 486 class of processors, including 486SX/20, 486SX/25, 486DX/25, 486DX/33, 486DX2/50, and 486DX/50, with prices ranging from $2,604 to $3,204. Although these products performed well

The Axik Ace Cache 486ALL! Series

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You're special to us.

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Your account is now 60 days **PAST DUE.** We hope you are paying more attention to your guppies than you are to us. Remit your payment to avoid further action.

Please pay your bill so we can pay our bills.

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3rd and FINAL NOTICE

Your account is now ***Seriously Delinquent.*** If you do not pay the total amount due by Friday midnight, your guppies will be repossessed, your credit damaged and your fishing license revoked.

Remember, we know where your guppies live.

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Thank You

We appreciate your prompt payment. As always, we value your patronage and we look forward to seeing you soon.

P.S. By now, *you've discovered the phenomenal rate at which a Tahitian Swayback Guppy grows. Coincidentally, for a* ***limited time, our*** *100-gallon aquariums are now on sale.*

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and are competitively priced given their level of features, some revealed a lack of attention to detail, and all are difficult when it comes to upgradability.

The Axik's tower case distinguished itself with a smooth, slightly rounded face that held a large front-mounted power switch. Three 5.25-inch and two 3.5-inch drive bays are accessible from the front, and on the inside you will find two additional 3.5-inch drive bays.

FACT FILE

Axik Ace Cache 486ALL! Series

Axik Computer Inc., 1031F E. Duane Ave., Sunnyvale, CA 94086; 800-234-2945, 408-735-1234; fax, 408-735-1437

List price (tested configuration): 486SX/20, $2,604; 486SX/25 upgrade, $50; 486/25 upgrade, $200, 486/33 upgrade, $250, 486DX2/50 upgrade, $400, 486/50 upgrade, $600

Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K external cache.

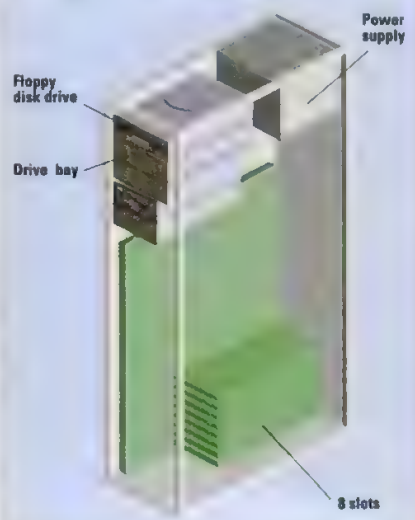
Disk drives and controller: Maxtor 7213AT 210MB IDE hard disk with a 64K buffer, Promise Technology DC 2031 IDE pass-through controller with a 4MB RAM cache, 1.2MB and 1.44MB floppy disk drives.

Display: ATI Ultra graphics adapter with 1MB of VRAM and 512K DRAM, ViewSonic 6E 14-inch monitor, 72-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1, mouse.

In short: The Axik Ace Cache 486ALL! Series was a spectacular performer on our benchmark tests and has a competitive price; its ease of upgrading was not the best of the group, but it was not the worst of those we looked at in this roundup

500 ON READER SERVICE CARD



The motherboard uses a customized Contaq chip set, along with an AMI system BIOS that is easily upgradable via a ZIF (zero-insertion-force) socket, and two clock crystals you can select with a jumper. There is also a socket for the 80487SX math coprocessor.

There are eight 16-bit expansion slots, one of which has a proprietary 32-bit extension that will eventually be used for local-bus video, according to the company. At review time, however, this slot was occupied by a standard 16-bit ATI Ultra graphics card. Axik claimed that its proprietary local-bus video wasn't ready in time for testing. Six slots were left empty on the system that came to PC Magazine Labs.

The company configured the system with 8MB of RAM, a Maxtor hard disk that is supported by a 16-bit Promise Technology hard disk controller with a 4MB RAM cache, 5.25-inch and 3.5-inch floppy disk drives, and a 14-inch ViewSonic monitor.

Though the motherboard has most of the features necessary to compete with the best in this review, it suffers from several design flaws. For instance, accessibility is limited unless you remove the bottom 3.5-inch drive bay. On our test unit, this bay was loose to begin with, which made its removal easy, though this situation didn't add to the stability of the case.

Getting to the SIMMs was not any easier, because they are located at the end of the expansion slots and under a tangle of cables. Also, if you want to install any 5.25-inch drives, you will have to remove the power supply first.

Once you get to the motherboard, the upgrading process consists of first removing the full-length expansion cards over or near the processor. Then you must loosen the ZIF socket's lever and pop out the old processor. The next step is to insert the replacement processor, and then switch to the proper clock crystal setting. If you're upgrading to a DX/50, you will also have to redo your BIOS configuration.

The Axik scored well on our processor test. Because of its 4MB disk adapter cache, the Axik led or came close to leading in disk performance across its processor classes. The design really stood out when it came to the DOSmark scores, and it took top honors in all of its four processor categories in terms of its Graphics Winmark results. The best of the bunch was the 486DX/50.

Axik provides a 13-month warranty on parts and labor, and a year of free on-site service covered by Nationwide; to extend the warranty a second year, you will need to spend $99.—*OR*

Blue Star Marketing

Blue Star Upgradable

The upgrade path of Blue Star Marketing's $2,077 386/33 ISA mini-tower, the Blue Star Upgradable, is somewhat involved: It starts with changing the clock crystal, followed by removing the old processor with a chip puller, and replacing it with the new CPU. In these days of relatively easy upgrade paths, such as ZIF (zero-insertion-force) sockets and CPU cards, this method leaves a lot to be desired. The company did its best to make this procedure as trouble-free as possible, though.

The ZEN motherboard has two sockets, one for 386 chips and one for 486 upgrades. The upgrade procedure is well-documented: To move up within a processor family—from a 386/25 to a 386/33, for example—you will need to pull out the processor chip and the clock crystal and replace them with the new version of each; the next step is to reset two jumpers on the motherboard.

We encountered two major design flaws with the test unit: The clock crystal socket was loose, and its vertical layout couldn't hold the crystal in. To compensate for the problem, many companies include tie-wraps to put around the crystals. Blue Star requires that you buy a

The Blue Star Upgradable

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new tie wrap.

Upgrades between the 386 and 486 levels are easier because you don't need to remove the 386 chip: The system's new processor will automatically sense and override the 386 processor. The only thing you will need to do is replace the clock crystal.

In terms of processor speed, the Blue Star performed above the average with the 386/33 installed, average at the other processor levels (Am386/40, 486SX/20, 486SX/25, 486DX/33, 486DX2/50, and 486/50). Its memory results were disappointing, consistently below the average or placing last. In addition, the unit's Maxtor hard disk performed below-average on our disk test. Its DOS-based video performance was disappointing, but the graphics adapter's S3 chip set outperformed many others when it came to the Graphics Winmark scores.

Upgrading the Blue Star PC from a 386 to a 486 does not require that you remove the old chip; the system will override the 386 CPU.

The tower system cost $2,077 with a 386DX/33 processor, 8MB of RAM, a 211MB hard disk, a Diamond Stealth card with 1MB of VRAM, and a 14-inch monitor. The ISA motherboard has nine expansion slots (six 16-bit and two 8-bit) and one proprietary 32-bit slot for memory. Two of the 16-bit slots can accept only half-length boards if the 486 chip has a heat sink on it. Six 5.25-inch and two 3.5-inch drive bays offer plenty of room for future expansion.

Blue Star offers a one-year warranty on parts and labor, plus on-site service through U.S. Net for an additional $59.—*WPF*

FACT FILE

Blue Star Upgradable

Blue Star Marketing, 2312 Central Ave., Minneapolis, MN 55418; 800-950-8884, 612-788-5000; fax, 612-788-3442

List price (tested configuration): 386/33, $2,077; Am386/40 upgrade, $149; 486SX/20 upgrade, $149, 486SX/25 upgrade, $149, 486/33 upgrade, $449, 486DX2/50 upgrade, $649, 486/50 upgrade, $799

Memory and processor RAM cache: 8MB 60-ns SIMMs, 64K cache.

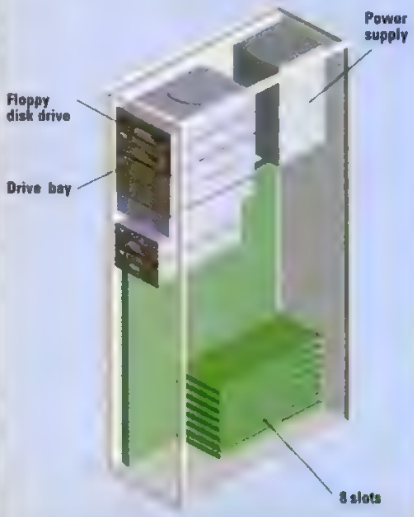
Disk drives and controller: Maxtor 7213AT 211MB IDE hard disk with a Blue Star controller, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond Stealth adapter with S3 chip set and 1MB VRAM, CTX CVP-5468Ni 14-inch monitor, 60-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1, PC Calc, PC File, PC Write.

In short: The Blue Star Upgradable offers a good price and performance, but it unfortunately had a problematic clock crystal.

501 ON READER SERVICE CARD



BOSS Technology Corp.

BOSS CEO

The BOSS CEO (Computer Enhancement Option) offers a large amount of expansion, very easy upgradability, and above-average performance. But as is often the case, this EISA-based PC is pricey but comes with many high-quality components; the top-of-the-line BOSS CEO with a 486DX/50 processor installed costs $6,995; with an AMD Am386/40 processor, it costs $5,746.

Our test unit had 8MB of RAM (the on-board maximum is 128MB), a Seagate 240MB hard disk run by an AMI Series 44 SCSI host adapter with 4MB of RAM, and an S3 chip–based Diamond Stealth video adapter with 1MB of VRAM paired with a CTX 14-inch monitor. Seven EISA slots line the motherboard, which is manufactured by AMI; one held the caching controller card, and another was occupied by the video. The I/O ports were located on the motherboard.

There are three families of upgrade boards, and each board can hold processors of the same family, but of different speeds. This gives you two upgrade paths: You can either swap the board or just the processor.

You can perform upgrades two ways: Upgrade the 386/33 card to an Am386/40 by pulling and replacing the silicon, or replace the board with a 486DX/25-based one. And the 486DX/33 board can go the rest of the way to 486DX/50 and 486DX2 processors. When swapping cards, no other components need be set. But when upgrading processors on each card, you will need to reset some jumpers; this procedure is clearly spelled out in the documentation.

We tested the BOSS CEO with an Am386/40, 486SX/20, 486SX/25, 486DX/33, and 486DX/50 processor. Performance for 486-based systems was mixed: Its processor test scores, for instance, were slightly above-average with the 486DX/33 chip, near the best with the DX/50, and subpar with the SX/20.

On our memory test, the BOSS CEO turned in some great numbers, due in part to the 128K of 12-nanosecond direct-mapped write-back cache. Its disk performance was also impressive, with the Seagate controlled by an AMI SCSI controller with 4MB of RAM. The DOS-based video test scores were below the average, due in part to the Stealth board's S3 chip set.

The system's interior is well orga-

The BOSS CEO

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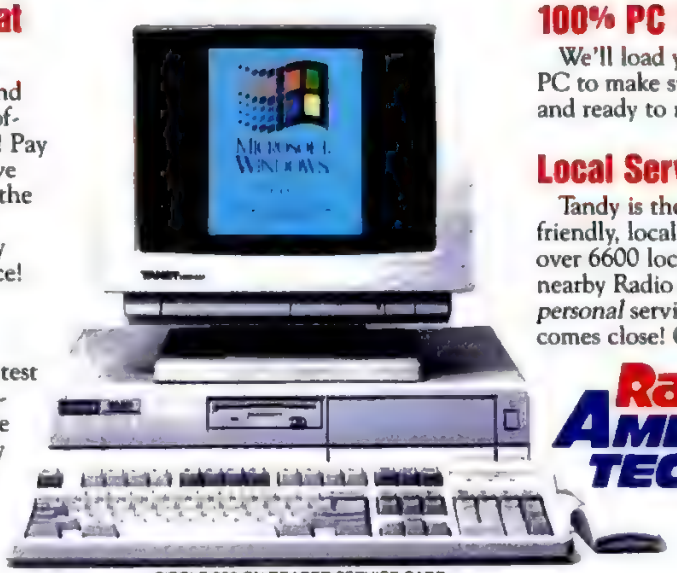

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CIRCLE 289 ON READER SERVICE CARD

FACT FILE

BOSS CEO

BOSS Technology Corp., 2546 NE Expwy., Atlanta, GA 30345; 800-628-1787, 404-636-2126; fax, 404-321-1499

List price (tested configuration): 386/40, $5,746; 486SX/20, $5,600; 486SX/25, $5,700; 486DX/33 upgrade, $554; 486/50 upgrade, $1,249.

Memory and processor RAM cache: 8MB 70-ns SIMMs, 128K cache.

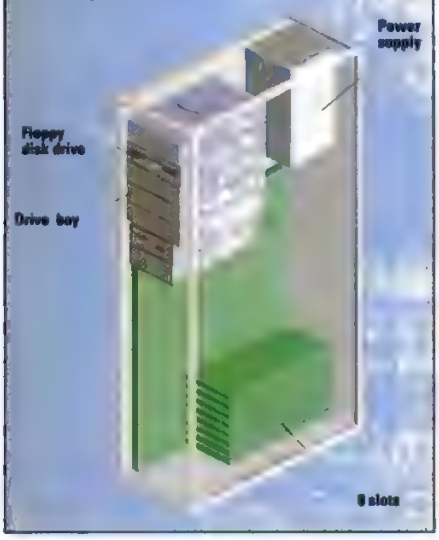
Disk drives and controller: Seagate ST3283N 240MB SCSI hard disk, AMI Series 44 caching disk controller with 4MB RAM, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond Stealth adapter with S3 chip and 1MB VRAM, 14-inch CTX CVP-5468A monitor, 60-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The BOSS CEO has an easy upgrade path, and on our benchmark tests, it was an above-average performer. Unfortunately, all this is accompanied by a high price.

902 ON READER SERVICE CARD



nized. None of components block the EISA slots, and all the cables are neatly arranged and tied off. The company should have added a second fan near the processor card, however, because the SCSI controller card, which spanned the length of the system, blocks most of the air flow from the fan in the power supply.

The documentation included with the system was thorough and clear. BOSS Technology Corp. offers a warranty that includes two years of on-site service and two years on parts and labor from TRW.—*WPF*

Clover Computer Systems Inc.

Clover 486-I Series

An easily upgradable ISA mini-tower, the Clover 486-I Series is priced at $2,895 with a 486DX2/50 processor. Unfortunately, its uneven performance on most of our tests indicates that you can buy a better computer for the money.

Our test unit had 8MB of 70-nanosecond RAM (the unit's maximum is 32MB) and a Maxtor 200MB hard disk. Video consisted of a QuickPath Cyclone XG2 video adapter with an S3 chip–based accelerator and a 14-inch monitor. DOS 5.0 and Microsoft Windows 3.1 came preinstalled, as was PC Vaccine, which is a virus protection package.

QuickPath also made the ISA motherboard, which holds the CPU socket, a Weitek coprocessor socket, and a 64K cache that is upgradable to 256K. Two of the eight 16-bit ISA slots hold the video and I/O cards. Alternative processors for the 486-I Series in this configuration range in price from the 486SX/20 (which costs $2,490) to the 486DX2/66 (with a price of $3,660).

A ZIF (zero-insertion-force) socket on the motherboard facilitates upgrades. You do have to reset the jumpers and change the clock crystal, but jumper settings imprinted on the motherboard help. A word of advice: Make sure you firmly secure the crystal; if you don't, the loose crystal may cause the system to crash.

On our benchmark tests, the 486-I Series generally performed below the average. Its processor performance was above-average. Disk test scores were average, but the unit's S3 chip–based video, however, produced above-average Graphics Winmark results.

The Clover 486-I Series

Standing 18.5 inches tall, this PC h eight drive bays: three 5.25-inch and fi 3.5-inch. An interesting touch is the 5.2 inch bay that held a combination 1.2M and 1.44MB floppy disk drive; anoth drive bay housed the hard disk.

Clover Computer Systems offers three-year warranty on the motherboar video adapter, and I/O card; the warran covers the rest for one year. On-s service is free the first year fro Nationwide, which has over 600 loc tions.—*WPF*

FACT FILE

Clover 486-I Series

Clover Computer Systems Inc., 1430 Koll Circle #102, San Jose, CA 95112; 800-925-6837; fax, 408-436-0494

List price (tested configuration): 486SX/20, $2,49 486/33 upgrade, $245; 486DX2/50 upgrade, $375; 488 50 upgrade, $485; 486DX2/66 upgrade, $1,140.

Memory and processor RAM cache: 8MB 70-n SIMMs, 64K cache.

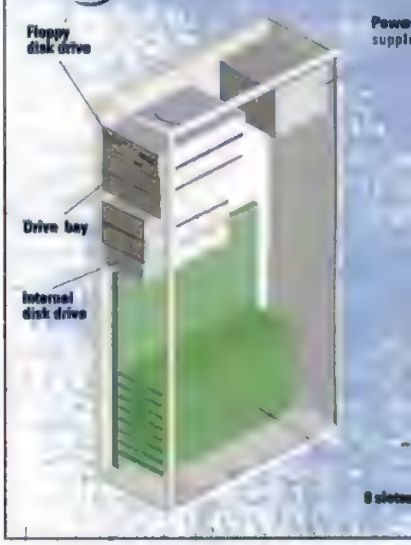
Disk drives and controller: Maxtor LXT213A 200M IDE hard disk with an internal 64K buffer, QuickPat Portfolio controller, combination 1.2MB and 1.44M floppy disk drive.

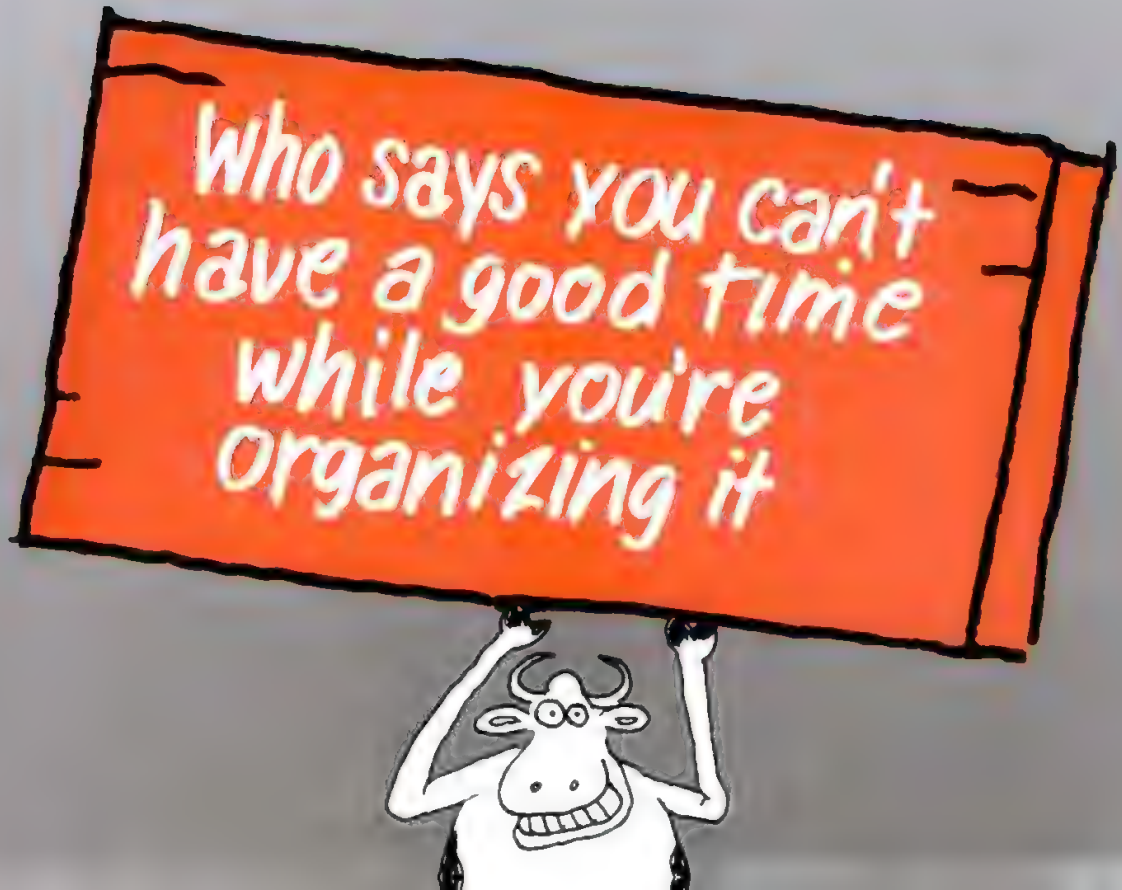
Display: QuickPath Cyclone XG2 video adapter wit S3 chip set and 1MB VRAM, ADI Microscan-3E 1 inch monitor, 72-Hz refresh rate at 1,024-by-768.

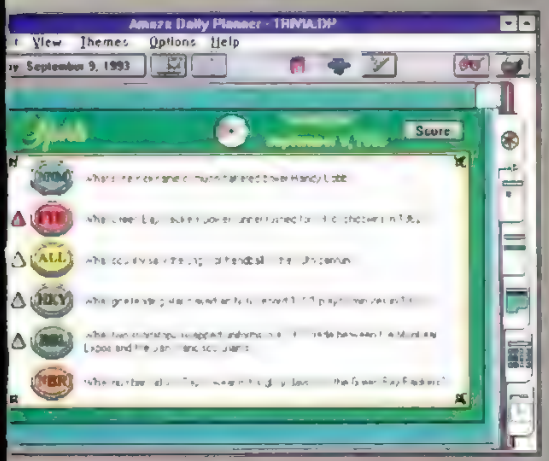
Software: DOS 5.0, Microsoft Windows 3.1, P Vaccine.

In short: The Clover 486-I Series provides easy up gradability and a good price, which are offset by subpa performance.

903 ON READER SERVICE CARD




Who says you can't have a good time while you're organizing it



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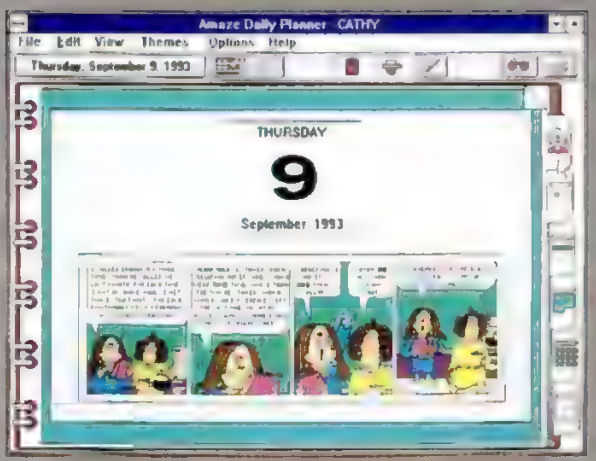

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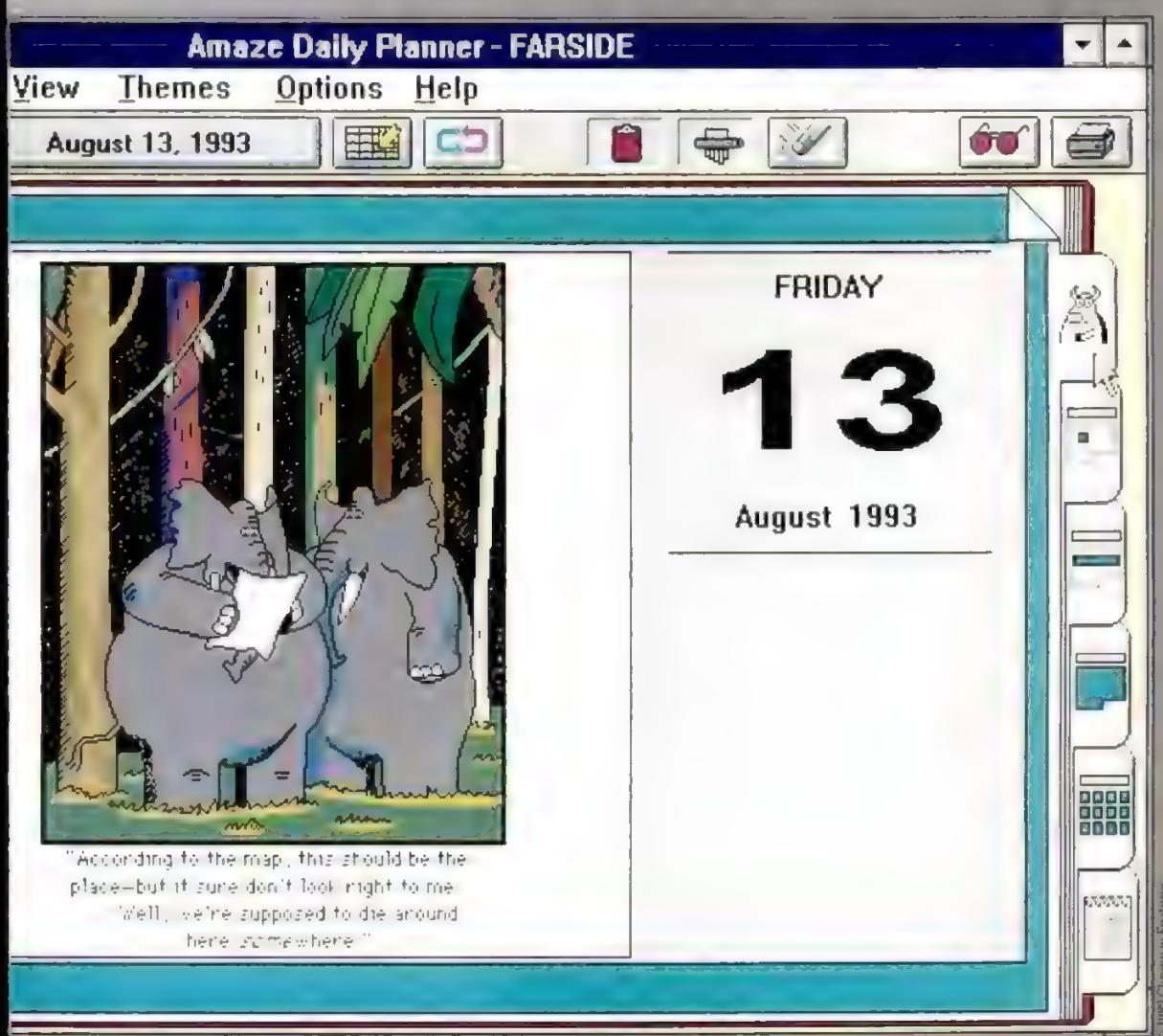

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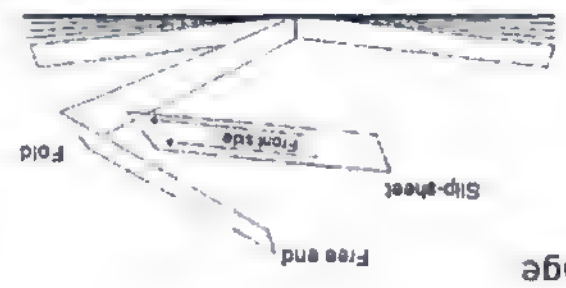
Folded edge of the page

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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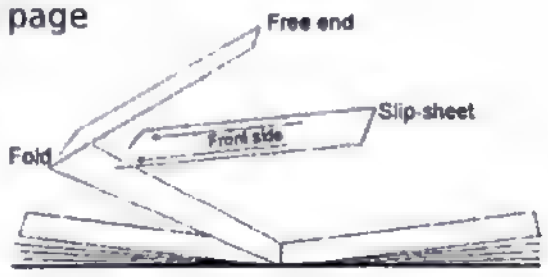
Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Back

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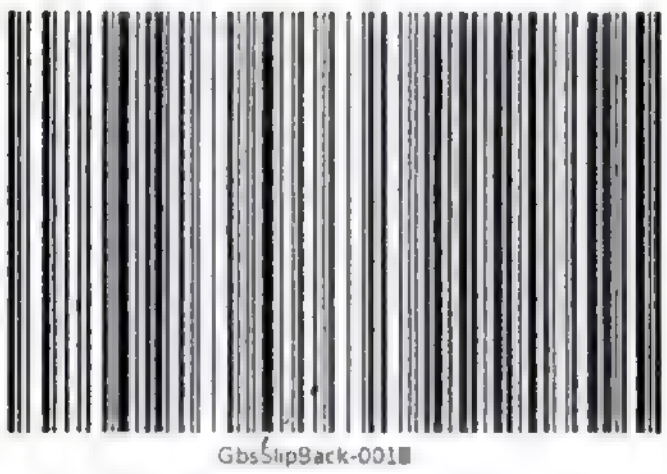
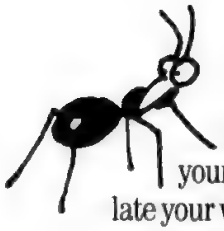


Back

1. Follow instructions on the other side



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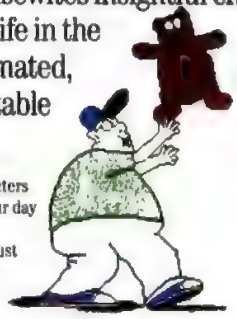

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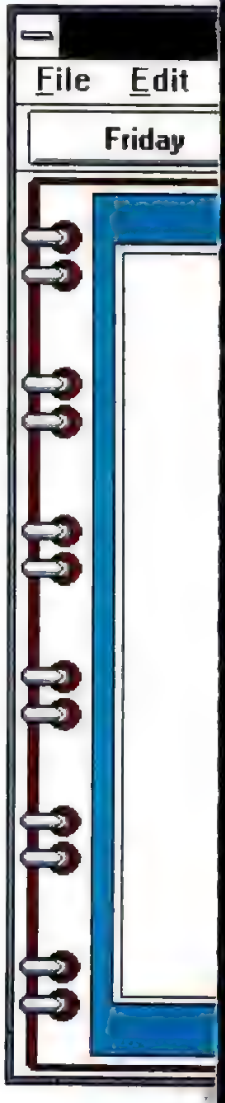

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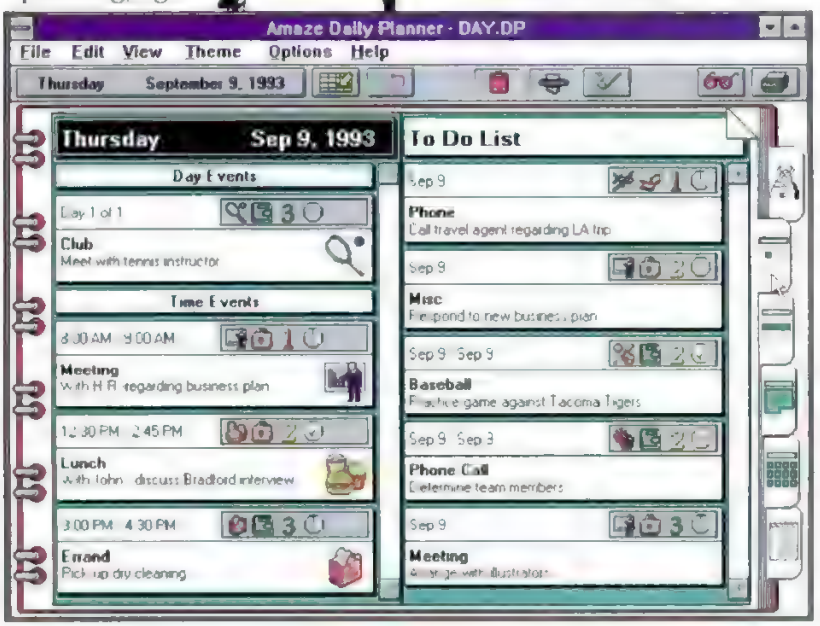

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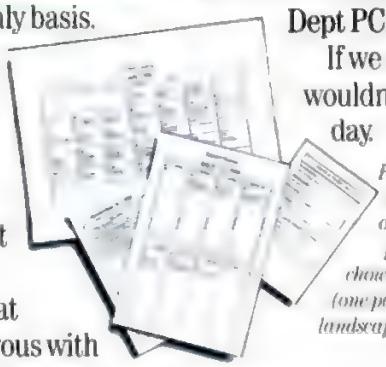

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Club American Computers Inc.

Club Falcon 325

The Club Falcon 325 combines performance, a low price, and ease of upgradability. By offering pricing between $2,242 and $2,816, Club American Computers does a good job of mixing high-quality engineering and adequate benchmark test results.

The standard desktop case (a tower version is also available) holds three external 5.25-inch drive bays, two of which are occupied by floppy disk drives. Internally there is only one 3.5-inch bay, which on the tested system was claimed by the hard disk. The power switch is side-mounted, while the reset and system LEDs are on the front. There is no turbo switch.

Inside, you will find Club's proprietary motherboard equipped with an AMI system BIOS, seven 16-bit ISA-bus slots, and one proprietary 32-bit slot occupied by the Falcon's processor card. In addition to the CPU, the card holds a variable external cache (256K on our test unit), a Weitek math coprocessor socket, and up to 64MB of RAM. The Quantum ProDrive hard disk's 256K buffer was augmented by a 2MB Promise Technology pass-through controller. A Diamond SpeedSTAR Plus graphics adapter based on a Tseng chip set handled the video.

Upgrading the Falcon was a straightforward procedure. Pull out the old processor card, insert the new one, turn on the power switch, and the PC whirs along at a faster speed. We did encounter a problem with the 486SX/25 processor, which could run only at a bus speed of 6.25 MHz, creating a bottleneck when it came to the PC's performance.

Another problem concerned the Falcon's crowded motherboard layout: Two expansion slots are relegated to only half-length cards because of the SIMM memory bank placement. The I/O ports ran off the multifunction Promise disk controller, but half of them were wired into the rear bracket of a neighboring slot, making that slot somewhat cumbersome to use.

On our benchmark tests, the Falcon was a mediocre performer, though it was consistently near the bottom in terms of disk performance. With a 256K external cache, it managed average numbers on the memory test in the lower processor classes, but it failed to keep up in the 486DX/33 and 486DX2/50 categories.

The company bundles this system with DOS 5.0, Microsoft Windows 3.1, and a Microsoft mouse. The Falcon also comes with a one-year warranty on parts and labor, as well as on-site service the first year.—*OR*

FACT FILE

Club Falcon 325

Club American Computers Inc., 3401 W. Warren Ave., Fremont, CA 94538; 800-524-2582, 510-683-6688; fax, 510-490-2687

List price (tested configuration): Basic-configuration Club Falcon 325, $2,242; 386DX/33 processor module, $50; 486SX/20 processor module, $125; 486SX/25 processor module, $150; 486DX/33 processor module, $300; 486DX2/50 processor module, $700. The price for each processor module includes a $500 rebate.

Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K external SRAM cache.

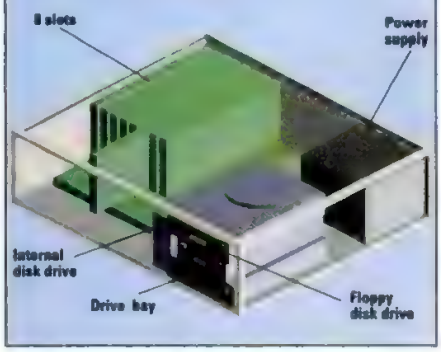
Disk drives and controller: Quantum ProDrive LPS 240MB IDE hard disk with internal 256K buffer, Promise Technology 2032 hard disk controller with a 2MB cache, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond SpeedSTAR Plus adapter with 1MB of video DRAM, Club 500B monitor, 62-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1, Microsoft mouse

In short: The Club Falcon 325's low price, extra-easy upgradability, and adequate performance make it one of the real high-flyers of this roundup. It is worth a very close look.

984 ON READER SERVICE CARD



The Club Falcon 325

Compaq Computer Corp.

Compaq Deskpro I

Compaq Computer Corp. aims its Compaq Deskpro I Series at the lower end of the market, leaving the rest to its flagship Compaq Deskpro M (also reviewed in this issue). But even at the low end, you

FACT FILE

Compaq Deskpro I

Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX 77070; 800-345-1518, 713-370-0670

List price (tested configuration): 386/25, $2,547; 386/33, $2,647; 486SX/25 upgrade, $299; 486DX/33 upgrade, $599

Memory and processor RAM cache: 8MB 80-ns SIMMs, 64K external SRAM cache.

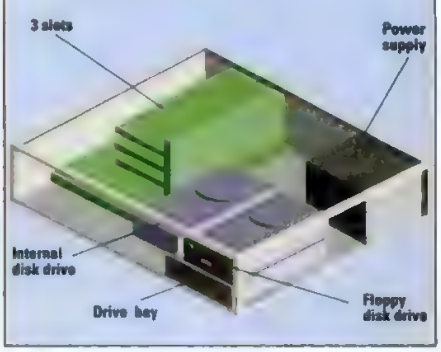
Disk drives and controller: Conner CP3201G 210MB IDE hard disk, Compaq on-board disk controller, 1.44MB floppy disk drive.

Display: Compaq motherboard video subsystem with QVision chip set and 1MB video DRAM, Compaq 14-inch 461 monitor, 72-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Compaq Deskpro I series is a well-constructed and neatly packaged slimline with a fairly easy upgrade path. It also comes with a higher-than-average price tag.

985 ON READER SERVICE CARD



The Compaq Deskpro I

will find rock-solid construction, iron-clad compatibility, and attention to detail. You will also find a slightly higher-than-average price tag for a 386DX/25 system: $2,547.

The slimline case holds a single 1.44MB floppy disk drive mounted in one of three 5.25-inch drive bays; two of these are front-accessible and one is internal. It also has its power, turbo, and reset switches located on the attractively styled front.

The Deskpro I's internal layout was typically clean, but marred by a few flaws. While the unit integrates many features onto the motherboard, including the drive controller, I/O ports, and video, the existence of only three vertically mounted ISA expansion slots could be highly restrictive when you want to expand in the future.

Upgradability isn't its strong suit, either. The 386 processor is located by the 486 upgrade socket. This socket is fairly easy to reach, but you're going to have to do some serious delving to get to the SIMM banks, located behind a metal internal divider and underneath the hard disk assembly. Jumper switches are easy to find, and the Deskpro I system automatically updates the CMOS settings.

The system has 8MB of RAM (expandable to 32MB on-board) buffered by an upgradable external cache (which can hold between 16K and 64K) and a Conner 210MB IDE hard disk. Compaq's QVision video chip set with 1MB of video DRAM is mated with a proprietary 14-inch monitor, which is capable of a VESA-compliant 1,024-by-768 resolution at a vertical refresh rate of 72 Hz.

ZD Labs tested the unit with 386DX/25, 386DX/33, 486SX/25, and 486DX/33 processors. The 486SX/25 and 486DX/33 varieties performed above the average for their classes, while the rest were in line with their counterparts. Its memory and disk test scores were average across both the DOS and Windows landscapes, but the on-board video excelled, particularly when we tested it in the Windows environment.

Compaq markets the Deskpro I through dealers and offers a one-year warranty on parts and labor, plus free on-site service from GE Computer Services or InteLogic Trace.—*OR*

Compaq Computer Corp.

Compaq Deskpro M

The $4,968 EISA Compaq Deskpro 50M received an Editors' Choice award in our September 15, 1992, review of DX2/50 PCs. Since that product was based on upgrade technology, we decided to see how it would stack up against the upgradables we corralled here. For a complete review, please refer to that issue; we're just going to concentrate on upgradability in this review.

If all you are interested in is upgradability, look no further. The Deskpro M is not only easy to upgrade, its performance benefit is worth doing so. The downside is that you have to pay a premium price to get the engineering and design of this system.

After plugging in a new processor card (which also holds the external cache and a second processor socket on some models), we merely ran the EISA configuration program and started testing. The documentation Compaq Computer Corp. sent with this PC was wonderful and shone with a professional polish.

The Compaq Deskpro M

The Deskpro 50M excelled on performance as well. We tested it across the 386DX/25, 386DX/33, 486SX/16, 486SX/25, 486DX/33, 486DX2/50, and 486DX2/66 processors. Its processor test scores were very competitive across the board, with the DX2/50 and DX2/66 chips particular standouts. The memory and disk test results were both average on all platforms. Compaq's QVision EISA video card zoomed along with above-average results in DOS and scored the best we've ever seen in Windows.

This machine comes with a one-year parts-and-labor warranty and free on-site service the first year from GE Computer Services or InteLogic Trace.—*OR*

PC MAGAZINE EDITORS' CHOICE

FACT FILE

Compaq Deskpro M

Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX 77070; 800-345-1518, 713-370-0670

List price (tested configuration): 386DX/25, $4,147; 386/33 upgrade, $399; 486SX/25 upgrade, $449; 486/33 upgrade, $999; 486DX2/50 upgrade, $1,699; 386DX2/66 upgrade, $2,179.

Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K cache.

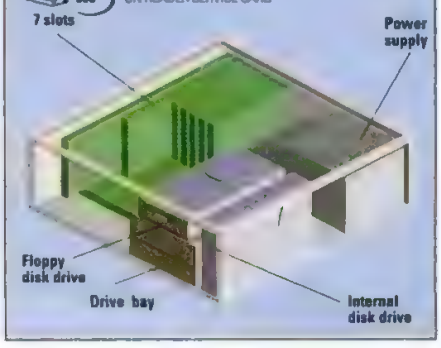
Disk drives and controller: Conner 16-ms 212MB IDE hard disk with 64K buffer, Compaq controller, 1.44MB floppy disk drive.

Display: Compaq QVision 1024/E 1,024-by-768 adapter with 1MB VRAM, Compaq QVision 15-inch monitor, 72-Hz refresh rate at 1,024-by-768 resolution.

Software: DOS 5.0, Microsoft Windows 3.1, Compaq mouse

In short: The Compaq Deskpro 50M rated an Editors' Choice distinction in our story of September 15, 1992, and now it rates another. It may cost more, but you get a very powerful system with an extremely easy upgrade path

506 ON READER SERVICE CARD



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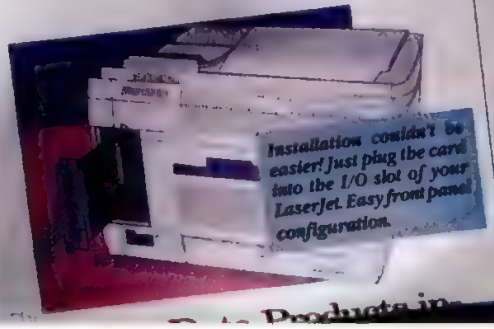

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Service and Reliability

Some 8,592 *PC Magazine* subscribers rated 34 PC vendors on four key service and reliability measures: overall reliability, satisfaction with both repair experience and technical support, and whether they would buy again from the vendor. Gateway 2000 and Zeos excelled.

We published the results of *PC Magazine*'s 1992 Service and Reliability Survey in our May 26, 1992, issue. As an aid to comparing computer vendors, we have summarized the numerical results in the accompanying table. Two companies were consistently in the top five for all four categories: Gateway 2000 and Zeos International. Buyers were happy with their purchases, satisfied with the technical support and repair service, and would likely buy again from Gateway or Zeos.

The results are based on 17,000 questionnaires sent to randomly chosen *PC Magazine* subscribers. From that initial mailing, we received 8,592 replies—a 51 percent response rate. We calculated an average score for each manufacturer, based on responses reported on a scale of 1 ("not at all satisfied") to 10 ("very satisfied"). As with any sample survey reporting average ratings, there is a margin of error associated with each composite score. Therefore, small differences in ratings may not be significant.

For more details on the methodology or results, consult our May 26 issue.

The 1992 PC Magazine Service and Reliability Survey

Desktop PCs

Overall PC reliability		Future likelihood of buying from the vendor		Satisfaction with repair service		Satisfaction with technical support	
Gateway 2000	9.13	Gateway 2000	9.02	Zeos International Ltd.	8.82	Northgate Computer Systems	8.82
Zeos International Ltd.	9.08	Zeos International Ltd.	8.58	Gateway 2000	8.73	Swan Technologies	8.69
Swan Technologies	8.95	Northgate Computer Systems	8.06	Northgate Computer Systems	8.69	Dell Computer Corp.	8.67
Hewlett-Packard Co.	8.87	Swan Technologies	7.98	Dell Computer Corp.	8.53	Zeos International Ltd.	8.50
AST Research	8.77	Austin Computer Systems	7.91	Austin Computer Systems	8.44	Gateway 2000	8.44
Dell Computer Corp.	8.77	Dell Computer Corp.	7.77	CompuAdd Computer Corp.	8.42	CompuAdd Computer Corp.	8.25
Compaq Computer Corp.	8.75	CompuAdd Computer Corp.	7.65	Swan Technologies	8.38	Digital Equipment Corp.	8.00
Northgate Computer Systems	8.75	Toshiba America Information Systems	7.34	Hewlett-Packard Co	8.33	Everex Systems	8.00
CompuAdd Computer Corp.	8.74	AST Research	7.33	AST Research	8.21	Hewlett-Packard Co.	7.95
IBM Corp.	8.74	DTK Computer	7.28	DTK Computer	8.20	Austin Computer Systems	7.93
Toshiba America Information Systems	8.74	Everex Systems	7.17	Everex Systems	8.16	AST Research	7.78
Austin Computer Systems	8.65	Packard Bell Electronics	7.05	IBM Corp.	8.10	DTK Computer	7.58
Apple/Macintosh	8.59	Apple/Macintosh	7.00	Unisys Corp.	8.10	IBM Corp.	7.48
Everex Systems	8.59	Advanced Logic Research	6.77	Acer America Corp.	8.09	Toshiba America Information Systems	7.46
NCR Corp.	8.58	Hewlett-Packard Co.	6.76	Toshiba America Information Systems	8.02	NCR Corp.	7.45
Packard Bell Electronics	8.57	Acer America Corp.	6.72	NCR Corp.	8.01	Acer America Corp.	7.43
Tandy Corp./GRiD Systems Corp.	8.56	PC Brand	6.62	Apple/Macintosh	7.99	Unisys Corp.	7.35
DTK Computer	8.55	NEC Technologies	6.54	PC Brand	7.94	Epson America	7.31
NEC Technologies	8.55	Compaq Computer Corp.	6.43	Compaq Computer Corp.	7.93	PC Brand	7.26
Unisys Corp.	8.55	Epson America	6.18	Digital Equipment Corp.	7.91	Tandon Corp.	7.26
Epson America	8.52	NCR Corp.	6.17	NEC Technologies	7.91	Apple/Macintosh	7.25
Acer America Corp.	8.49	IBM Corp.	5.90	Packard Bell Electronics	7.76	Memorex Telex Corp.	7.23
Advanced Logic Research	8.48	Hyundai Electronics America	5.75	Epson America	7.75	Compaq Computer Corp.	7.22
PC Brand	8.48	Texas Instruments	5.29	Texas Instruments	7.69	Advanced Logic Research	7.18
Hyundai Electronics America	8.43	Tandy Corp./GRiD Systems Corp.	5.17	Advanced Logic Research	7.63	NEC Technologies	7.18
Texas Instruments	8.33	Leading Edge Products	5.14	Zenith Data Systems	7.49	Texas Instruments	7.16
Leading Edge Products	8.32	Zenith Data Systems	5.07	Tandy Corp./GRiD Systems Corp.	7.48	Hyundai Electronics America	6.98
AT&T Computer Systems	8.21	Memorex Telex Corp.	5.02	AT&T Computer Systems	7.38	Zenith Data Systems	6.97
Zenith Data Systems	8.18	Digital Equipment Corp.	4.99	Wang Laboratories	7.37	Tandy Corp./GRiD Systems Corp.	6.92
Digital Equipment Corp.	8.17	Tandon Corp.	4.97	Memorex Telex Corp.	7.28	Packard Bell Electronics	6.88
Wyse Technology	7.99	Unisys Corp.	4.92	Wyse Technology	7.28	Wang Laboratories	6.70
Wang Laboratories	7.91	Wyse Technology	4.71	Hyundai Electronics America	7.27	Wyse Technology	6.64
Memorex Telex Corp.	7.81	AT&T Computer Systems	4.61	Leading Edge Products	7.25	AT&T Computer Systems	6.45
Tandon Corp.	7.58	Wang Laboratories	4.39	Tandon Corp.	7.14	Leading Edge Products	5.88
Average	**8.51**	**Average**	**6.42**	**Average**	**7.93**	**Average**	**7.48**

Scale: 1 (lowest rating) to 10 (highest rating)

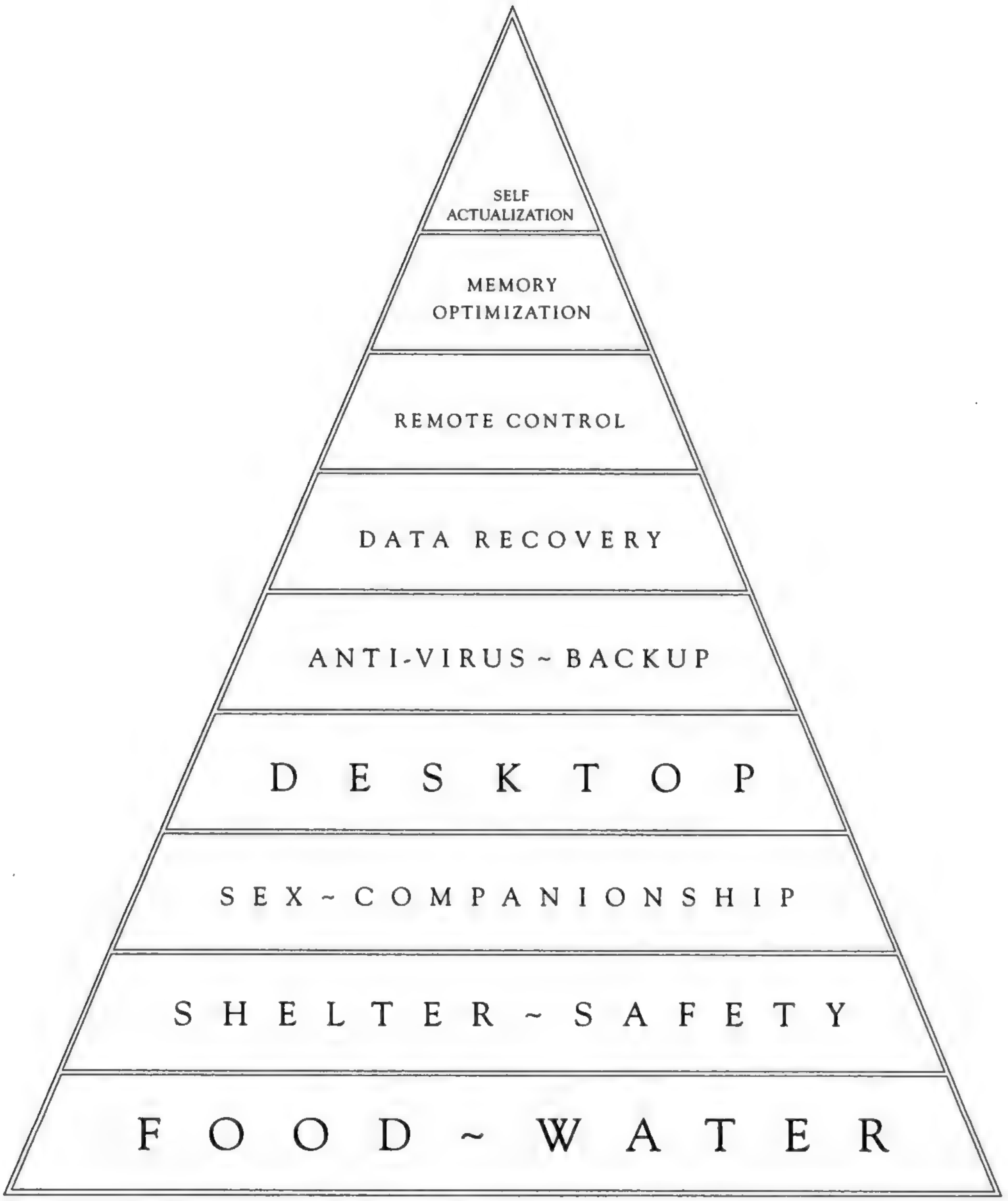
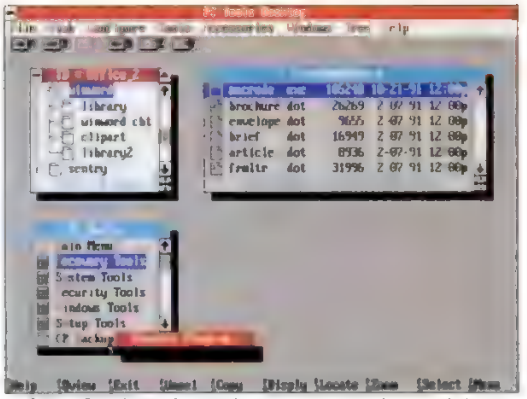
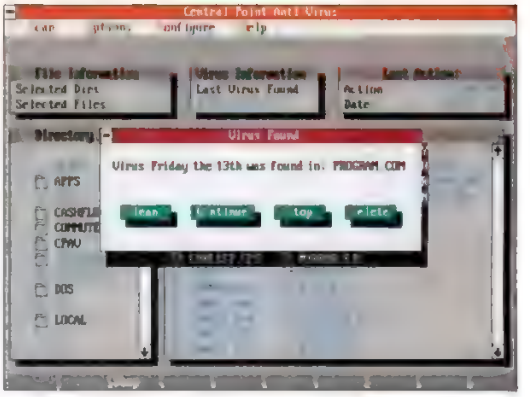


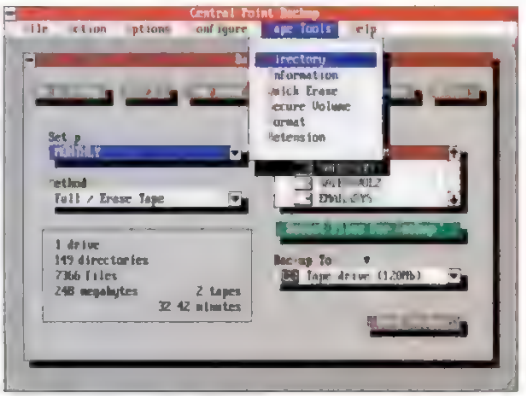
fig. [1]
Maslow's Hierarchy of Needs.



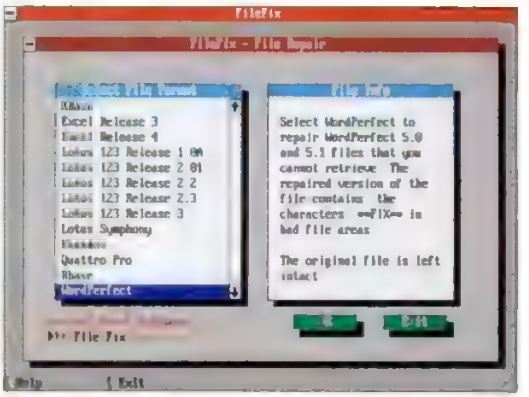
[New] PC Tools Desktop gives you a drag-and-drop interface that makes file and program management easy



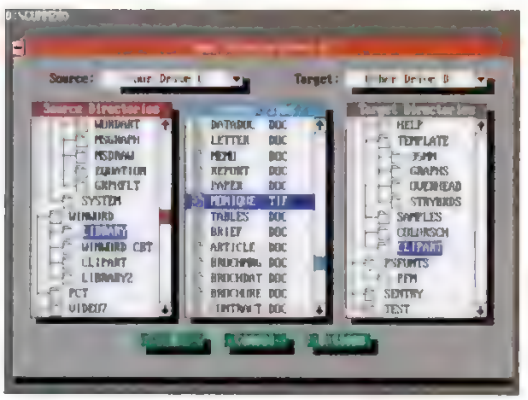
[New] Detect and remove over 1,300 viruses with our complete Central Point® Anti-Virus program.



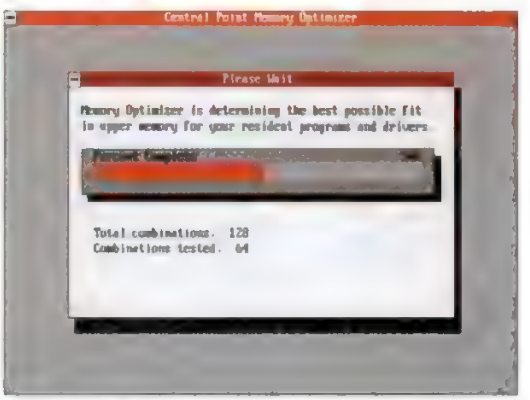
[New] Central Point Backup now supports SCSI drives and lets you format and erase tapes from inside the program.



[New] FileFix repairs more application files than ever before, including WordPerfect, Excel and Quattro Pro.



[New] Commute runs faster Windows and DOS sessions and makes file transfers even more convenient.



[New] RAMBoost memory optimizer takes full advantage of DOS 5 and frees up more memory for your applications.

[New] Task switching lets you move between multiple DOS applications faster and easier.

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CIRCLE 081 ON READER SERVICE CARD

CompuAdd Express

CompuAdd Scalable Systems

The solidly made and practically engineered CompuAdd Scalable Systems costs $2,295 equipped with an AMD Am386DX/40 processor, proof that the industry-wide price war is making for happy buyers. Arriving in a slimline desktop case, the CompuAdd holds one front-accessible 5.25-inch drive bay (filled with a space-efficient combination 1.2MB and 1.44MB floppy disk drive), one front-accessible 3.5-inch drive bay, and one internal 3.5-inch bay occupied by the Conner hard disk. Though the unit mounts the power switch near the front on the right side, there are no reset or turbo switches, and no LEDs.

The BCM Advanced Research motherboard runs with AMI system BIOS, mounts the processor on the motherboard, and is also equipped with local-bus video. System RAM (4MB minimum and 32MB maximum on-board) was boosted by a nonvariable 128K external SRAM cache. The IDE Conner 212MB hard disk had its own 64K buffer and was wired directly into the motherboard. BCM's own video card sat in the local-bus slot and revolved around a Tseng chip set with 1MB of video DRAM. A 14-inch CompuAdd monitor had surprisingly good ergonomic features and bright on-screen colors for a bundled monitor.

Upgrading the CompuAdd was a fairly simple procedure, but not nearly the easiest we encountered. You will have to break out your chip puller, but the documentation provides clear instructions, although it erroneously said the machine could handle a DX/50 processor. The only difficult part was reaching a few of the speed jumpers tucked away under the hard disk assembly.

We tested the CompuAdd with the AMD Am386DX/40, Cyrix Cx486DLC/33, and Intel's 486SX/25, 486DX/33, and DX2/50. The system produced average results on our processor test; its memory test results were a little below the average. Its disk times were average under both the DOS and Windows platforms, while the local-bus video excelled under DOS and managed competitive results under Windows.

CompuAdd backs this system with a one-year parts-and-labor warranty, with toll-free technical support and free next-day on-site service for one year. It also allows an exchange within 30 days if the system doesn't work properly.—*OR*

The CompuAdd Scalable Systems

FACT FILE

CompuAdd Scalable Systems

CompuAdd Express, 12306 Technology Blvd., Austin, TX 78727; 800-925-3000, 512-219-2800; fax, 512-219-2890

List price (tested configurations): Basic configuration, $2,295; Cx486DLC/33 upgrade, $179; 486SX/25 upgrade, $199; 486DX/33 upgrade, $499; 486DX2/50 upgrade, $649; 486DX2/66 upgrade, $799.

Memory and processor RAM cache: 16MB 70-ns SIMMs, 128K cache.

Disk drives and controller: Conner CP3204F IDE 212MB hard disk with internal 64K buffer, combination 1.2MB/1.44MB floppy disk drive.

Display: BCM Advanced Research local-bus video with Tseng ET4000AX chip set and 1MB of video DRAM, CompuAdd S1109 14-inch monitor, 72-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1.

In short: Though not the easiest to upgrade, this unit has good performance, solid construction, and local-bus video

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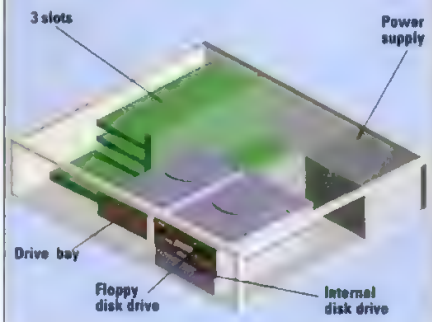

Comtrade

Comtrade 486 Local Bus Win-Station

Although $2,875 is not a lot to pay for a 486/50 ISA mini-tower machine, the Comtrade 486 Local Bus Win-Station disappoints on ugradability. The economical move would be to spend $250 more and get the 486DX2/66 version.

Upgrading seems straightforward: Use a chip puller to replace the CPU, change the jumper settings, and replace the crystal and BIOS. But the clock crystal, which sits between the Weitek coprocessor socket and various VLSI chips, had to be unsoldered from the motherboard—not a good place to use a soldering iron. Comtrade sent us another system, this one with a crystal socket. But other problems remained. The 3.5-inch drive bay cage blocked access to parts of the motherboard and had to come out. And the glue on the 486 chip's heat sink slid off after the unit warmed up.

Our test unit came with a 256K cache, 8MB of RAM (128MB is the system maximum), and a 203MB Western Digital Caviar hard disk. Six drive bays (three 5.25-inch and three 3.5-inch) offer plenty of room. The motherboard has seven 16-bit expansion slots and one proprietary local-bus slot that holds the Join Data IDE hard disk controller. The system's local-bus motherboard ran the video adapter, a Join Data G-Host S3 Plus card with 1MB of VRAM. The system came with a 15-inch monitor. Comtrade claims that the local-bus design, together with the local-bus IDE controller, increases the data transfer rate by 70 percent. How-

The Comtrade 486 Local Bus Win-Station

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EPSON

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ever, the card covers three slots, leaving only five open. Since the card can be used only in the local-bus slot at the bottom of the row, all the cables running to it further crowd what is otherwise a roomy system.

Across all classes, the Comtrade turned in above-average processor performance. But its memory scores were below the average. The S3 accelerator helped put its scores on our Graphics Winmark test well above the average.

The documentation, another area where Comtrade seems to run into trouble, consisted of component manuals that were sketchy and unclear in places. Fortunately, the warranty is substantial: two years on parts and labor and a year of free on-site service.—*WPF*

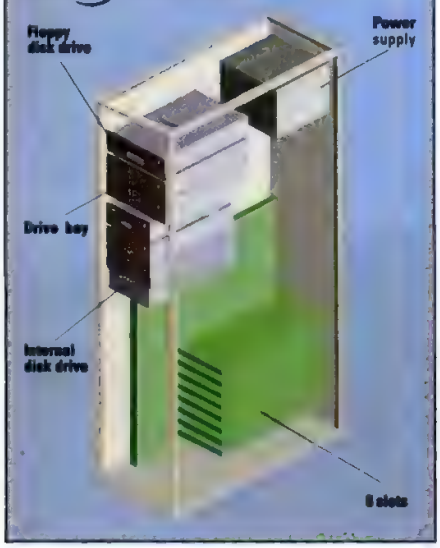
FACT FILE

Comtrade 486 Local Bus Win-Station

Comtrade, 15314 E. Valley Blvd., City of Industry, CA 91746; 800-969-2123, 818-961-6688; fax, 818-369-1479

List price (tested configuration): 486SX/25, $2,375; 486/33 upgrade, $300; 486DX2/50 upgrade, $500; 486/50 upgrade, $600; 486DX2/66 upgrade, $750.
Memory and processor RAM cache: 8MB 60-ns RAM, 256K cache.
Disk drives and controller: Western Digital Caviar 2200 203MB IDE hard disk with 64K cache, 1.2MB and 1.44MB floppy disk drives.
Display: Join Data Viper S3 Plus adapter with 1MB VRAM, MAG MX15F 15-inch monitor, 76-Hz refresh rate at 1,024-by-768.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: This machine is very difficult to upgrade. On the other hand, $3,125 will get you a 486DX2/66 and save you the hassle.

586 ON READER SERVICE CARD



CUBE Computer Corp.

CUBE ATX Upgradable System

The CUBE ATX Upgradable System offers good performance and quality components but might be considered expensive at $3,595 for a 486DX/50 system. We also found it difficult to upgrade.

With five drive bays (two 5.25-inch and three 3.5-inch), this ISA mini-tower is designed to be compact yet capable of expansion. However, many of the CUBE's motherboard components are blocked by a 3.5-inch drive bay cage. To reach the motherboard you must disconnect and remove this cage. That means lifting the cage out and over the expansion slots, so it's best to take out any cards first. Another handicap is the lack of a ZIF (zero-insertion-force) socket, although CUBE says that the next generation will include it. And you'll still have to reset the jumper switches, but these are well diagramed in the documentation.

The Deico motherboard has seven slots: one 8-bit and six 16-bit. The unit's 8MB of RAM (the on-board maximum is 64MB) incorporates a 128K cache (CUBE now includes 256K standard). The 212MB Conner hard disk is connected to a controller integrated on the motherboard. The Orchid Fahrenheit 1280° board, with its S3 chip, is coupled to a Sony monitor.

The Am386DX/40, 486SX/25, 486DX/33, 486DX/50, and 486DX2/66 processors achieved average scores, except when we tested it as a DX/50; as such, it suffered in terms of video, memory, and disk performance. The CUBE led the SX/25 group in terms of memory performance. The documentation is well-organized and has many useful charts; CUBE offers a one-year warranty with on-site service available for $50 for the first year.—*WPF*

The CUBE ATX Upgradable System

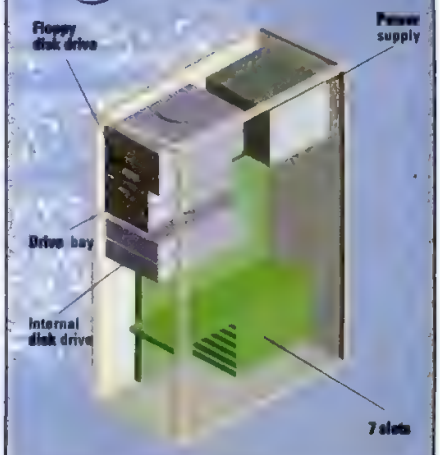
FACT FILE

CUBE ATX Upgradable System

CUBE Computer Corp., 150 Clearbrook Rd., Elmsford, NY 10523; 800-522-2823, 914-592-8282; fax, 914-592-3482

List price (tested configuration): 386/40, $2,995; 486SX/25, $100; 486DX/33, $400; 486DX2/50, $400; 486DX/50, $600 486DX2/66 upgrade, $800.
Memory and processor RAM cache: 8MB 60-ns SIMMs, 128K cache.
Disk drives and controller: Conner CP3204F 212MB IDE hard disk with internal 256K buffer, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid Fahrenheit 1280° adapter with 1MB VRAM, Sony Trinitron Multiscan SG CPD1304S, 70-Hz refresh rate at 1,024-by-768.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The CUBE ATX Upgradable System is expensive, and component placement makes it difficult to upgrade.

586 ON READER SERVICE CARD



Deico Electronics Inc.

Deico Predator

Prices for the Deico Predator range from $2,170 for a 386DX/33 to $3,085 for a 486DX2/66. While its motherboard supports a wide range of processors, it takes some effort to reconfigure it. The Predator's standard desktop case houses five

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front-accessible drive bays: three 5.25-inch and two 3.5-inch. Unfortunately, the placement of the 3.5-inch bays makes it difficult to access the processor sockets (especially in 386 models).

Deico uses its own motherboard with an AMI BIOS and a Symphony chip set. Our unit had 8MB of RAM (64MB is the maximum) with a 256K cache. One of the seven ISA slots held the video adapter; the rest were empty. Four slots can take full-length cards. Sockets for a 386 and 486 are mounted on the motherboard, as is the clock crystal. Two problems stood out: the complexity of the jumpers and difficulty in accessing the processor sockets, SIMM banks, and processor cache.

The Deico Predator

The 212MB IDE Western Digital Caviar hard disk with a 64K internal buffer is connected to a controller integrated onto the motherboard. A 1MB Diamond SpeedSTAR 24 video adapter with a Tseng ET4000 chip set displays on a 14-inch ViewSonic monitor, which has a 60-Hz refresh rate at 1,024-by-768. System documentation was complete but unorganized and lacked an index. We ran the Predator through its paces with an Am386DX/40, Cx486DLC/33, and Intel 386DX/33, 486SX/25, 486DX/33, 486DX/50, 486DX2/50, and 486DX2/66 processor. Its processor test scores were slightly below the average across all the platforms; memory and disk test results, however, were competitive. The video card yielded above-average DOS graphics and average or slightly below-average Windows scores.

Deico offers a two-year parts-and-labor warranty on the motherboard and one year on all other components. On-site service from Integrated Automation International is $75.—*OR*

FACT FILE

Deico Predator

Deico Electronics Inc., 2800 Bayview Dr., Fremont, CA 94538; 800-321-8990, 510-651-7800; fax, 510-651-6109

List price (tested configuration): 386DX/33, $2,170; Am386DX/40 upgrade, $88; 486SX/25 upgrade, $165; Cx486SLC/33 upgrade, $245; 486DX/33 upgrade, $485; 486DX/50 upgrade, $590; 486DX2/50 upgrade, $555; 486DX2/66 upgrade, $915.

Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K 20-ns SRAM cache.

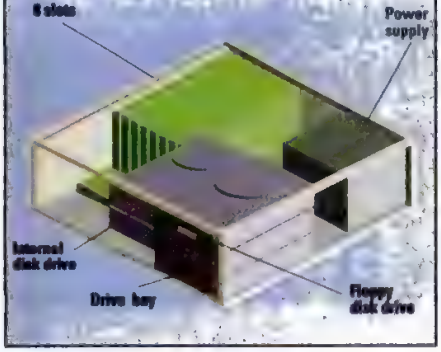
Disk drives and controller: Western Digital Caviar 2200 IDE 212MB hard disk with 64K buffer, Deico integrated controller, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond SpeedSTAR 24 graphics card with 1MB of video DRAM and Tseng chip set, ViewSonic 6 14-inch monitor, 60-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Deico Predator is well-priced, a strong performer, and one of the most versatile—though complex—upgradable systems around.

910 ON READER SERVICE CARD



Dell Computer Corp.

Dell 486 DE Family

Dell has been making waves recently by cutting prices, but it hasn't cut corners on quality. If you work primarily in DOS, the $3,069 486SX/25 EISA-based Dell 486 DE Family won't disappoint you.

The 486 DE was one of the best when it came to upgrading. Pulling out the old card and plugging in the new one is all it takes, with no jumpers or system reconfiguration. Excellent documentation made the job even easier. The small-footprint case has three accessible half-height 5.25-inch bays and two 3.5-inch internal bays. A Quantum ProDrive 230MB IDE hard disk with a built-in 256K buffer fills the internal bay, and a combination 1.2MB/1.44MB floppy disk drive fits into a 5.25-inch bay. Power and reset switches are on the front.

The 486 DE Family's EISA motherboard carries Dell's own system BIOS, six EISA slots, and a proprietary slot for the plug-in processor. The video, I/O, and disk controller are on the motherboard, leaving plenty of expansion slots free. The placement of the ROM battery and fan, however, makes the SIMM banks a little difficult to reach. Other system components were of impeccable quality, though the 8MB of RAM lacked an external cache. The plug-in processor card has a coprocessor socket. The on-board video, based on a Tseng ET4000 chip and 1MB of video DRAM, is connected to a 14-inch Dell UltraScan monitor that was a little below the par for the system, mainly due to some image fuzziness.

FACT FILE

Dell 486 DE Family

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355; 512-338-4400; fax, 512-338-8700

List price (tested configuration): With 486SX/25, $3,069; 486/33 upgrade, $400; 486DX2/50 upgrade, $400; 486DX/50 upgrade, $1,000.

Memory: 8MB 80-ns RAM.

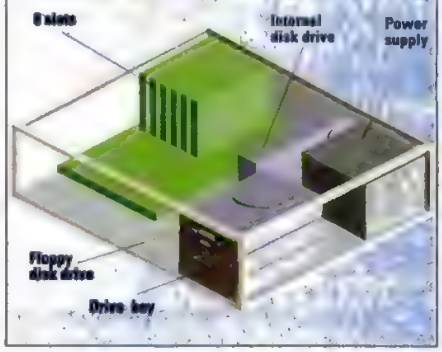
Disk drives: Quantum ProDrive LPS 240AT 230MB IDE hard disk with a 256K buffer, combination 1.2MB/1.44MB floppy disk drive.

Display: Dell integrated video Tseng ET4000 chip set with 1MB of video DRAM, UltraScan 14C 14-inch monitor, 70-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Dell 486 DE Family has excellent, high-quality components. This computer does come with a slightly high price tag, but not so high that it is no longer competitive.

911 ON READER SERVICE CARD



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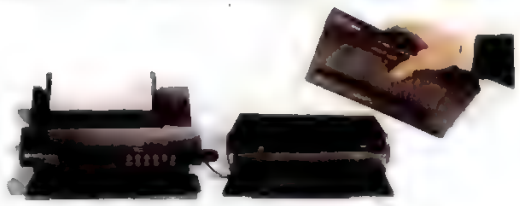

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486 Upgrade Alternatives

by Winn L. Rosch

Theoretically, you can upgrade any PC with less than a 486 processor to give it the features and power of a 486, if you have the time, inclination, and budget. Depending on the design of the base system, the upgrade can be as easy as sliding in an expansion board or as complex as replacing the motherboard.

PC Magazine Labs tested upgrade products from Kingston Technology Corp., Sigma Data, and Aox. The first two products replace the motherboard on the base system, the third utilizes the bus master on machines based on Micro Channel architecture.

The products work but may not make economic sense. The third-party 486-level updates that we found for nonupgradable PCs retail from $978 to $2,500. Many complete 486 systems now fall within that price range. Moreover, if you choose to buy a new PC, you'll still have your old machine to hand down to someone else, to use as a print server, or for emergencies.

Proponents of upgrades say the enhancement extends the life of a PC, or at least makes system performance more acceptable for its remaining days. But the lives of the components that aren't upgraded, such as the power supply, disk drives, and peripherals, are unchanged. A CPU upgrade could be like a heart transplant for a 90-year old.

Even the makers of upgrades agree that the most common arguments for upgrades don't make sense. They report that their customers describe the value of upgrading in different terms: The old PC gets a power boost without any need to duplicate or replace files, connections, or peripherals. Upgrading saves a technician from having to spend time copying files and plugging in peripherals. It spares the user from expending time becoming familiar with a new system.

THE BEST STRATEGY

If you can justify upgrading your old PC, replacing the entire motherboard is often the best strategy. The upgraded motherboard will give you the performance of a new system, because you get not only a new 486 microprocessor, but new support chips, an entirely new BIOS, and a memory system specifically designed for the needs of the 486. There are some downsides, primarily in the cost of the motherboard and the difficulty of the installation. Finding a motherboard that fits your old case can also be troublesome.

We discovered 33-MHz 486 ISA motherboards with street prices as low as $565, with CPU and 64K secondary cache, but no RAM. These are from manufacturers that are less than well-known: You'll pay more for name brands. Club American offers 486-based motherboards for the Compaq 286e ($1,116 for 33MHz) and 286 Deskpro ($978 for 33MHz) systems.

An alternate strategy for PCs with 386-based motherboards is to use 486 adapter boards that plug into CPU sockets. These products work only in 386-based PCs, because the 386 and 486 microprocessors have the same number of address and data connections; the 286 and earlier chips do not. Many plug-in 486 upgrades also need software drivers to activate the chip's built-in cache circuitry. The only driver may be for the current version of DOS.

Compatibility may be an issue. When we ran PC Labs' latest benchmarks on several board-level 486 upgrades, we found subtle problems that crashed the tests but did not affect the running of most applications. Such results don't mean these upgrades are fragile—benchmarks usually push products—but we have reservations about any claim of 100 percent compatibility made for plug-in 486 upgrades.

The plug-in chip upgrades we tried showed that installation is nothing to be taken lightly. A board-level upgrade for some models of 386-based PS/2s (Hyertec Hyperace 486DX/33, distributed in the U.S. by Sigma Data) requires the removal of hard disks and their bays. We found errors in the manual of the Kingston Technology 486/Now! for the Compaq Deskpro 386/16 models that added half an hour of troubleshooting time. We also fried two Compaq 25e motherboards with separate 486/Now! upgrades. According to Kingston Technology, both problems have been fixed.

We tried the $1,095 Kingston 486/Now! model 486/33CD3, a 33-MHz upgrade for Compaq Deskpro 386 Models 16, 20, 20e, 25, 25e, and 33. A companion product, the 486/33PD3, is designed for IBM machines. A small board about 3.4 inches square, the 486/33CD3 replaces a 386DX chip and contains its own 33-MHz crystal. Installation, a 15-minute job, requires only removing the old microprocessor, plugging in the 486/Now!, and adding two extra EEPROM chips. The ROMs extend the Compaq's BIOS to activiate the 486's internal cache without the need for software drivers.

Performance improved but fell short of a true 486 motherboard because the new CPU is limited by the slower memory timing of the base system. The upgrade was incompatible with our benchmarks, so we could not determine the level of improvement.

To similarly upgrade IBM PS/2s, we tried the $1,095 Hypertec Hyperace 486/33, an L-shaped board covered with surface-mount logic chips that shoehorns into the 386 socket on a 16- or 20-MHz Model 70 or 20-MHz Model 80 motherboard. No matter which system you have, installing the board requires removing the disk drive bays to reach the microprocessor socket. Once you've finished the complex physical installation, you're done. On-board silicon takes care of all compatibility issues, and your PS/2 will boot up as if it were built with a 486 inside. Microprocessor speed more than doubled over the base 386, memory speed was up by 25 percent, and disk performance accelerated by 38 percent. Video speed slowed a bit, however.

The advanced expansion bus in Micro Channel computers allows upgrades based on expansion boards that are particularly effective, though expensive. Bus mastering allows the upgrade board to wrest control of the system from the host microprocessor. To test this approach, we plugged a $2,500 Aox MicroMaster 486-33MHz into a 20-MHz PS/2 Model 70. The full-length MicroMaster plugs into any available PS/2 Micro Channel slot, 16- or 32-bit (the latter preferred). Finish the 5-minute, no-tools physical installation, and you need only run a quick, automatic configuration using the host system's Reference Disk. Once the board is recognized by your PS/2, it takes control through the Micro Channel's bus-mastering system.

The MicroMaster board ran smoothly in the Model 70, quadrupling processor speed, yet memory speed picked up only slightly. MicroMaster includes its own supply of RAM and uses IBM-style SIMMs, so you can move the modules from your system board to the MicroMaster, leaving only enough behind to boot your PS/2. Two SIMM sockets are available (standard memory is 0K), and the board accommodates up to 16MB using 8MB SIMMs. The Micro Channel connection with I/O circuitry slowed disk performance by about four percent and the Model 70's already slow VGA speed by about 18 percent, however. □

486/Now! 486/33CD3
Kingston Technology Corp., 17600 Newhope St., Fountain Valley, CA 92708; 800-835-6575, 714-435-2600
List price: $1,095.
Circle 544 on reader service card

Hypertec Hyperace 486/33
Sigma Data Inc., P.O. Box 1790, New London, NH 03257, 800-446-4525, 603-526-6909, fax 603-526-6915
List price: $1,095.
Circle 545 on reader service card

MicroMaster 486
Aox Inc., 486 Totten Pond Road, Waltham, MA 02154, 800-232-1269, 617-890-4402, fax 617-890-8445
List price: $2,500.
Circle 546 on reader service card

The Dell 486 DE Family

We tested the unit with a 486SX/25, 486DX/33, 486DX2/50, and 486DX/50 processor. All processor scores were subpar, probably due to the lack of an external cache; one would have been helpful for the lower-level processors and is crucial for the higher-level ones. Its results on our memory and DOS-based video tests were above the average, and its disk performance was average. Its Graphics Winmark scores were below the average and in many cases near the bottom—primarily a result of the DOS-oriented Tseng ET4000 video chip set.

The 486 DE is accompanied by a one-year warranty. On-site service is free the first year, and Dell offers a bonus of $25 if you have to wait for more than 5 minutes for technical service.—*OR*

Dell Computer Corp.

Dell 486 D Family

The $2,719 Dell 486 D Family didn't manage an Editors' Choice award in our October 13, 1992, review of 486SX/25 PCs, but because of its attractive design it was honorably mentioned. We therefore decided to compare it and a few other standout machines with the upgradables we reviewed this time. (If you want a full review of this system, refer to our October 13 issue.)

Speaking from a strictly upgradable point of view, though, the 486 D fared well. It wasn't the best we saw, mainly because the motherboard lacked a ZIF (zero-insertion-force) socket—which means a chip puller is a necessity—and because this PC uses jumper switches to change the system configuration. The best upgradable systems do away with the need for these complications. Within its limits, however, the 486 D made the upgrade process as painless as possible. The motherboard was fully integrated and cleanly designed, and it offered nearly unrestricted access to the processor sockets and memory banks. The system configuration jumpers were not as easy to reach. Tucked beneath the power supply, we could only reach them through a 1.5-by 3-inch slot in the chassis.

The computer's performance with multiple processors (486SX/25, 486DX/33, 486DX2/50, and 486DX2/66 chips) was competitive in all categories. The monitor, which burned out almost immediately, didn't fare as well. We simply replaced it with an identical model borrowed from the Dell 486 DE Family (also reviewed in this issue) and everything ran

FACT FILE

Dell 486 D Family
Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355, 512-338-4400; fax, 512-338-8700

List price (tested configuration): 486SX/25, $2,719; 486DX/33 upgrade, $300, 486DX2/50 upgrade, $500, 486DX2/66 upgrade, $700.

Memory and processor RAM cache: 8MB 80-ns. SIMMs

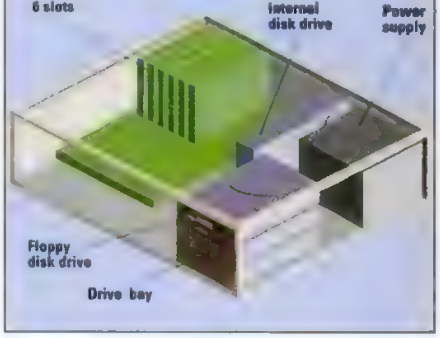
Disk drives and controller: Quantum ProDrive LPS 240AT 245MB IDE hard disk with internal 256K cache, Dell integrated controller, combination 1.2MB/1.44MB floppy disk drive.

Display: Western Digital WD90C31-LR integrated chip set with 1MB video DRAM, Dell UltraScan 14C 14-inch monitor, 70-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Dell 486 D Family managed an honorable mention a few months ago (October 13, 1992), and it stacked up well against the other upgradables here. Good performance, a nice price, and the company's renowned attention to quality make for another winner.

512 ON READER SERVICE CARD



The Dell 486 D Family

smoothly. Its memory test results were competitive, even though the unit lacked a secondary SRAM cache. The Quantum IDE hard disk pulled in low numbers despite the use of its internal 256K cache. The motherboard-integrated Western Digital video chip set (with 512K of video DRAM) managed above-average DOS-based video numbers; its Windows scores were slightly lacking.

Dell Computer Corp. backs all its products with a one-year parts-and-labor warranty, free first-year on-site service, and toll-free technical support.—*OR*

DFI Inc.

DFI Diamond Series Model 333D

Like some of the most successful processor-upgradable systems reviewed here, the $1,863 386/33-based DFI Diamond Series Model 333D has most of its system components on a proprietary slot card. However, poor quality control and DFI's lack of careful attention to detail mean this product is not a top choice.

Three drive bays (two 5.25-inch and one 3.5-inch) are accessible in the front of this sturdy small-footprint case, and one is an internal 5.25-inch bay. The DFI motherboard uses an AMI system BIOS and handles its 256K external cache via a UMC chip set. 8MB of SIMMs make up the system RAM (the maximum is 64MB). The small motherboard, however, requires placing a section of the memory banks in the area dominated by the seven expansion-card slots (one 32-bit, four 16-bit, and two 8-bit). The hard disk is a 118MB Western Digital Caviar IDE unit connected to a 16-bit DFI MIO-500 IDE pass-through controller without a cache. The Diamond Series system includes a monitor with digital and front-mounted image controls, as well as DOS 5.0, Windows 3.1, System Sleuth Professional software, and a Microsoft mouse.

The DFI Diamond Series Model 333D

FACT FILE

DFI Diamond Series Model 333D

DFI Inc., 135 Main Ave., Sacramento, CA 95838; 916-568-1234; fax, 916-568-1233

List price (tested configuration): Fully configured 386/33 system, $1,863; 486SX/20 DBV card, $209; 486SX/25, $262; 486DX/33 DBV card, $696, 486DX2/50 upgrade, $975.

Memory and processor RAM cache: 8MB 70-ns SIMMs with 256K external cache.

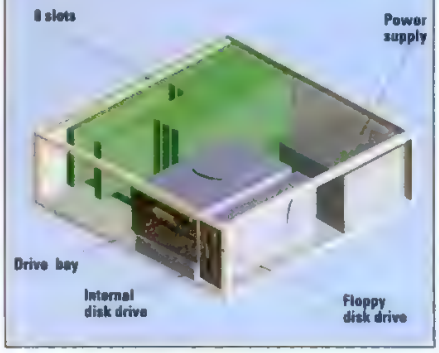
Disk drives and controller: Western Digital Caviar 2120 118MB IDE hard disk, DFI MIO-500 16-bit controller, 1.2MB and 1.44MB floppy disk drives.

Display: Local-bus video with a Tseng ET4000 chip set with 1MB of video memory, ADI MS-3E monitor, 60-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1, System Sleuth Professional, mouse.

In short: The DFI Diamond has a very competitive price. It uses the easy plug-in CPU-card upgrade method, but due to some erratic engineering decisions, this PC is still not the easiest to upgrade. Other system flaws combine to make this a difficult recommendation.

513 ON READER SERVICE CARD



With the exception of the hard disk controller, the DFI's plug-in processor card holds everything else, including the local-bus video. The downside, however, is that you lose all CMOS settings with every processor upgrade.

The DFI suffered quality control problems: the company sent an AMD Am386/40 CPU that could not function due to incompatible board timings; the 486SX/25 processor card was missing its clock crystal; and the 486SX/20 card was inappropriately equipped with a 25-MHz oscillator. Other system shortcomings include the need to remove the drive bays and hard disk to access the SRAM cache. And it would help if DFI rewired the I/O ports so that they don't hog one of the few empty 16-bit slots this system has left.

ZD Labs tested the DFI with 486SX/20, 486SX/25, 486DX/33, 486DX2/50, 486DX/50, and 486DX2/66 processors. Its performance on our processor, memory, and disk tests was average. In its favor, the system's local bus moved the DOS-based video scores above the mean.

DFI ships this PC with a one-year parts-and-labor warranty. Free on-site service from AT&T is available for the first year.—*OR*

Diamond Technologies Inc.

Diamond DT486XI

At $2,895, the 486SX/25 Diamond DT486XI is a competitively priced EISA machine. But a difficult upgrade process and gaps in the documentation remain problems.

Diamond Technologies' standard tower-size model contains three 5.25-inch and two 3.5-inch external drive bays; two more 3.5-inch bays are internal. Unfortunately, the power supply interferes with access to the 5.25-inch drive bays, and you must remove the lower drive bay assembly to get to the external cache.

The S&A Laboratories motherboard contains an AMI system BIOS and an OPTi chip set. An OPTi-controlled external cache with a capacity ranging from 64K to 512K uses 8MB of 70-nanosecond RAM (expandable to 128MB on-board). Of the eight EISA expansion slots, three are filled: one by an AMI EISA SCSI hard disk controller (holding a 4MB cache on our test system) connected to

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Helen Lim,
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Thinking Ahead.

a 340MB Maxtor SCSI hard disk, the second by a Diamond SpeedSTAR (despite similar names, there is no connection between the two companies) graphics adapter that is based on a Western Digital chip set with 1MB of video DRAM. Displayed on a CTX monitor, the card produced diluted colors and flickered. The third EISA slot carried an 8-bit I/O card that wires half its ports across three other expansion slots, an inconvenience if you plan expansion.

The upgrade process at first appeared to be straightforward: replace the processor chip in the ZIF (zero-insertion-force) socket and change the jumper settings. But on closer inspection, the ZIF socket showed an incorrect pin 1 position. Documentation was obscure where it described the jumper settings. Though DOS 5.0 and Microsoft Windows 3.1 were included, their manuals were not.

We tested the DT486XI across the 486SX/25, 486DX/25, 486DX/33, 486DX2/50, 486DX/50, and 486DX2/66 platforms. Its processor and memory test scores were average, although the SCSI hard disk produced impressive scores that topped most categories. Its SpeedSTAR card managed above-average DOS-based video and Windows scores.

Diamond includes a warranty that covers parts for 15 months and labor for two years; one-year of on-site service costs $75.—*OR*

The Diamond DT486XI

FACT FILE

Diamond DT486XI

Diamond Technologies Inc., 17165 Gillett Ave., Irvine, CA 92714; 800-989-7253, 714-252-1008; fax, 714-252-1508

List price (tested configuration): 486SX/25, $2,895; 486DX/25 upgrade, $200; 486DX/33 upgrade, $300; 486DX/50 upgrade, $500; 486DX2/50 upgrade, $400; 486DX2/66 upgrade, $700.

Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K external SRAM cache.

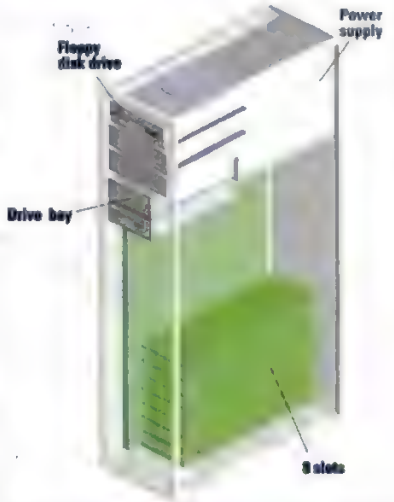
Disk drives and controller: Maxtor LXT 340S4 340MB SCSI hard disk, AMI Series 44 EISA Fast Caching SCSI controller with 4MB cache, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond SpeedSTAR 24X adapter with 1MB of video DRAM, CTX CVP-5468A, 70-Hz refresh rate at 800-by-600.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: A powerful and well-priced EISA machine, the Diamond DT486XI is marred by erratic engineering quality and shoddy documentation.

514 ON READER SERVICE CARD



Everex Systems Inc.

Everex Tempo M Series

The Everex Tempo M Series is a well engineered, detailed, and competitive system that is priced at $2,726 with a 486DX/33 CPU. Upgrading is easy, but the quality control is lacking.

The Tempo's small-footprint desktop case holds six 5.25-inch drive bays (three external and three internal). There is only one 3.5-inch floppy disk drive, but all those bays let you expand much more than just the processor.

The heart of the Tempo's upgrade scheme is a plug-in card that contains the processor (speedier chips are cooled by a heavy-duty heat sink), the socket-mounted BIOS, a clock crystal, an 80487 math coprocessorsocket, and jumpers to differentiate between processor platforms. The Everex motherboard has one 8-bit slot, six 16-bit ISA slots, and one proprietary slot. With effort, you can expand the 8MB of system RAM to 32MB on-board: The SIMMs are located beneath a jungle of drive cables and mounted flush with the integrated drive and I/O connectors. And although the video circuitry is integrated, the external VGA connector has been wired through the rear bracket of an expansion slot. Since video is not through a local bus, integrating it onto the motherboard was a space consideration, though that advantage has been negated by the loss of the slot. Despite the Tseng chip's ability to display 1,280-by-1,024, you will need a better monitor than the 14-inch unit supplied, which has 800-by-600 noninterlaced at 60 Hz. The hard disk is a 211MB Seagate IDE with a 64K buffer.

FACT FILE

Everex Tempo M Series

Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; 800-821-0806, 520-498-1111

List price (tested configuration): 386DX/25, $2,726; 386DX/33 upgrade, $199; 486SX/20 upgrade, $299; 486SX/25 upgrade, $299; 486DX/33 upgrade, $699; 486DX2/50 upgrade, $999

Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K external cache

Disk drives and controller: Seagate ST-1239A 211MB IDE hard disk with internal 64K buffer, integrated controller, 1.44MB floppy disk drive

Display: Everex motherboard video subsystem with Tseng ET4000 chip set and 1MB video memory, Everex 14-inch Mon-500 Super VGA multiscanning monitor, 60-Hz refresh rate at 800-by-600.

Software: DOS 5.0, Microsoft Windows 3.1

In short: If only the price of the Everex Tempo M Series were as competitive as its engineering

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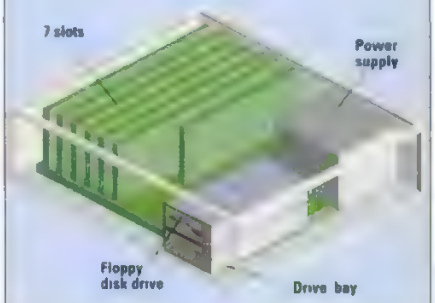

The Everex Tempo M Series

Upgrading the Tempo was easy: Pull out the old processor card and plug in the new. We did run into a few problems, however, with other parts of the system; for instance, the hard disk failed to respond due to a faulty factory CMOS setting—a quick fix once we discovered it. But we never found an easy way to modify the system's bus speed, which was irregular and required constant tweaking.

The Tempo was tested with 386DX/33, 486SX/20, 486SX/25, 486DX/33, and 486DX2/50 processors. Processor performance was above the average across all platforms, including DX2 designs, which depend heavily on an external cache for excellent performance. Its graphics performance under both DOS and Windows was competitive, as was its memory test score; its disk score was below the average.

The Tempo comes with DOS 5.0, Microsoft Windows 3.1, a two-button mouse, and excellent documentation. Everex offers a one-year parts-and-labor warranty; on-site service is free the first year from National Computer Systems.—*OR*

IBM Personal Computer Co.

IBM PS/2 Model 90

For some months now, the media has been discussing the price war that has brought turmoil to the computer industry and bargains to PC buyers. Major firms have been dropping prices—except for Big Blue, until now. The MCA-based IBM PS/2 Model 90 is a decent computer with a fairly easy upgrade process and solid though unremarkable performance. The disappointment, still, is the $4,225 price tag (with a 486SX/25 chip). Because many 486 computers sell for under $3,000, you have to decide how much IBM's reputation or Micro Channel architecture (MCA) is worth.

On the hardware side, the Model 90 is better than some. With its all-plastic, no-tools-needed design, the standard desktop case offers one external 5.25-inch bay, two external 3.5-inch bays (one occupied by a 1.44MB floppy disk drive), and one internal 3.5-inch bay. The power switch is front-mounted, but there is no reset or turbo switch.

IBM's motherboard has a refreshingly open and neat layout, with most components mounted on upgradable plug-in cards. The test unit's 8MB of memory (expandable to 64MB) was on one card, while another housed the processor and a 256K external cache. One of the four MCA slots holds the IBM SCSI hard disk controller with its 512K cache. IBM's 160MB SCSI hard disk is substantially smaller than those offered on many lower-priced systems. The graphics card–based video, capable of 1,024-by-768 (interlaced only), is based on an IBM chip set with 1MB of 100-nanosecond VRAM. The system's 14-inch monitor showed noticeable black spots.

Upgrading the Model 90 was fairly easy, although the manuals glossed over some of the more technical questions an experienced user might have.

We tested the Model 90 with a 486SX/25, 486DX/33, and 486DX2/50 processor. The unit performed competitively across all platforms on the processor and memory tests. DOS-based video test scores were average, but we had to run our Graphics Winmark test routines with a prerelease XGA-2 MCA adapter because the on-board video controller couldn't produce Super VGA resolution. Its disk scores were below the average.

IBM recently announced a new service strategy. Its HelpWare program will cover all systems for three years with on-site service. There's also a 30-day money-back guarantee.—*OR*

FACT FILE

IBM PS/2 Model 90

IBM Personal Computer Co., Rt. 100, Somers, NY 10589; 800-426-4329

List price (tested configuration): 486SX/25, $4,225; 486DX/33 upgrade, $935, 486DX2/50 upgrade, $1,385

Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K external cache

Disk drives and controller: IBM FRU56F8851 SCSI 160MB hard disk, IBM MCA FRU 85F0063 controller with 512K cache, 1.44MB floppy disk drive

Display: IBM XGA-2 video controller with an IBM TC110GC9AG chip set and 1MB of VRAM, IBM 8515 14-inch monitor, 70-Hz refresh rate at 720-by-400

Software: DOS 5.0

In short: IBM has delivered an average system in terms of engineering and performance; however, its price tag and below-average warranty and service policy are difficult pills to swallow.

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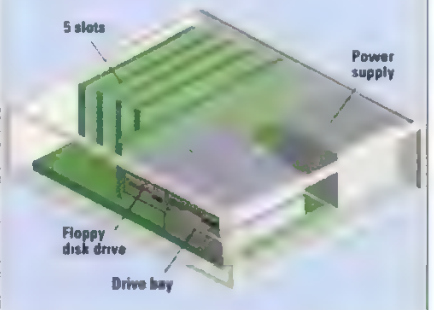


The IBM PS/2 Model 90

IBM Personal Computer Co.

IBM PS/2 Model 95

The IBM PS/2 Model 95, an MCA tower, is slightly higher-end than its desktop sibling, the IBM PS/2 Model 90. Though this system is well-engineered and was an exemplary performer, it lacked attention to detail, and its $5,115 list price with a 486SX/25 CPU is twice as expensive as those of comparable systems.

The first thing you will notice about the Model 95 is that it's huge. The full-size tower case supports five 5.25-inch front-accessible drive bays (two occupied

The best word processor for Windows is by Lotus.

Says who?

by floppy disk drives) and two 5.25-inch internal bays (one containing the hard disk). Opening this case is very simple and requires no tools. If you haven't read the documentation before you peek inside, however, you may be in for a shock. A massive 329-watt power supply and its retaining bracket covered fully half the motherboard. The documentation does tell you that this assembly is mounted on hinges that swing out, allowing free access to all parts of the system.

The Model 95's motherboard spans the full height of the case. It holds eight MCA expansion slots (two of which are occupied) and handles from 4MB to 64MB of RAM buffered by an external cache that can hold from 8K to 512K (our test system had 512K). Disk and video is exclusively an IBM affair: An IBM 400MB SCSI hard disk (one of the largest we saw) is controlled by a 32-bit MCA IBM controller, and video is run off an IBM XGA adapter, which holds 1MB of VRAM and is connected to a subpar 14-inch IBM monitor.

The IBM PS/2 Model 95

With its high level of accessibility, you would think the Model 95 would be a snap to upgrade. And it is, if you know what you're doing. Unfortunately, figuring out what you're doing can sometimes be infuriating because of the substandard documentation.

Performance results offer a prettier picture. We tested the Model 95 with a 486SX/25, 486DX/33, and 486DX2/50 processor; its processor and memory test scores were competitive across all three platforms. The SCSI hard disk turned in average scores under Windows but slightly below-average results under DOS. Video was well above the average under Windows but was only average under DOS.

IBM offers a newly introduced HelpWare service policy, including three-year warranty with on-site service and a 30-day money-back guarantee.—*OR*

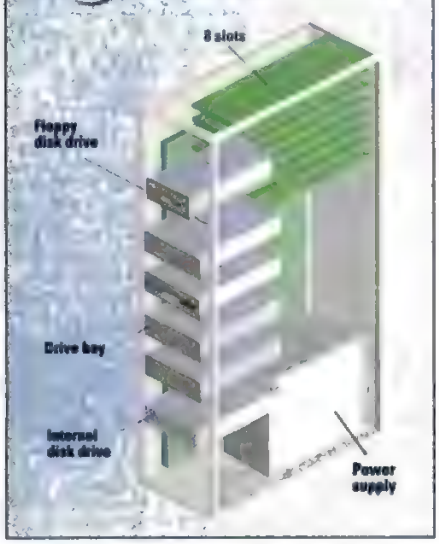
FACT FILE

IBM PS/2 Model 95

IBM Personal Computer Co., Rt. 100, Somers, NY 10589; 800-772-2227; fax, 800-426-4329

List price (tested configuration): 486SX/25, $5,115; 486DX/33 upgrade, $935; 486DX2/50 upgrade, $1,870.
Memory and processor RAM cache: 8MB 70-ns SIMMs, 512K 20-ns SRAM cache.
Disk drives and controller: IBM FRU:56F8851 SCSI 400MB hard disk, IBM MCA FRU 85F0063 controller with 512K cache, 1.44MB floppy disk drive.
Display: IBM XGA video controller with IBM TC110GC9AG chip set and 1MB of VRAM, IBM 8515 14-inch monitor, 70-Hz refresh rate at 720-by-400.
Software: DOS 5.0.
In short: Though its performance is solid, the IBM Model 95's price is weighty, especially after you examine that of the competition.

917 ON READER SERVICE CARD



International Instrumentation Inc.

Blue Max Monolith

The Blue Max Monolith from International Instrumentation ranges in price from the $1,897 low-end 486SX/20 to the $2,697 top-of-the-line 486DX2/66—not much to pay for this average-performing mini-tower, but the system's case is so packed with components that the upgrade process becomes difficult.

FACT FILE

Blue Max Monolith

International Instrumentation Inc., 2282 Townsgate Rd., Westlake Village, CA 91361; 800-543-3475, 805-495-7673; fax, 805-379-0701

List price (tested configuration): 486SX/20, $1,897; 486SX/25 upgrade, $100; 486DX/25 upgrade, $200; 486DX/33 upgrade, $300; 486DX2/50 upgrade, $400; 486DX2/66 upgrade, $800.
Memory and processor RAM cache: 8MB 70-ns SIMMs, 64K cache.
Disk drives and controller: Conner CP3204F 213MB IDE hard disk with internal 64K buffer, HyperStor 1600 caching controller with 1MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond Stealth Super VGA adapter with 1MB DRAM, ViewSonic 6 14-inch monitor, 60-Hz refresh rate at 1,024-by-768.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The Monolith's low price and fine performance may make this average-performing mini-tower desirable. The crowded case makes upgrades difficult.

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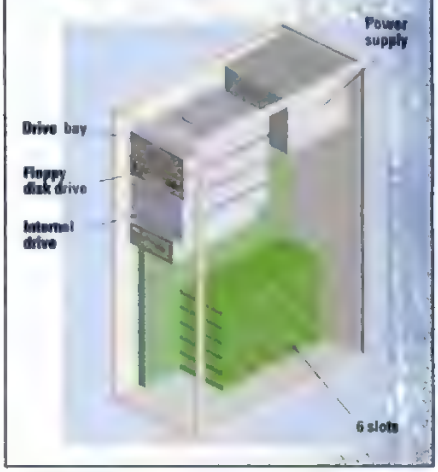
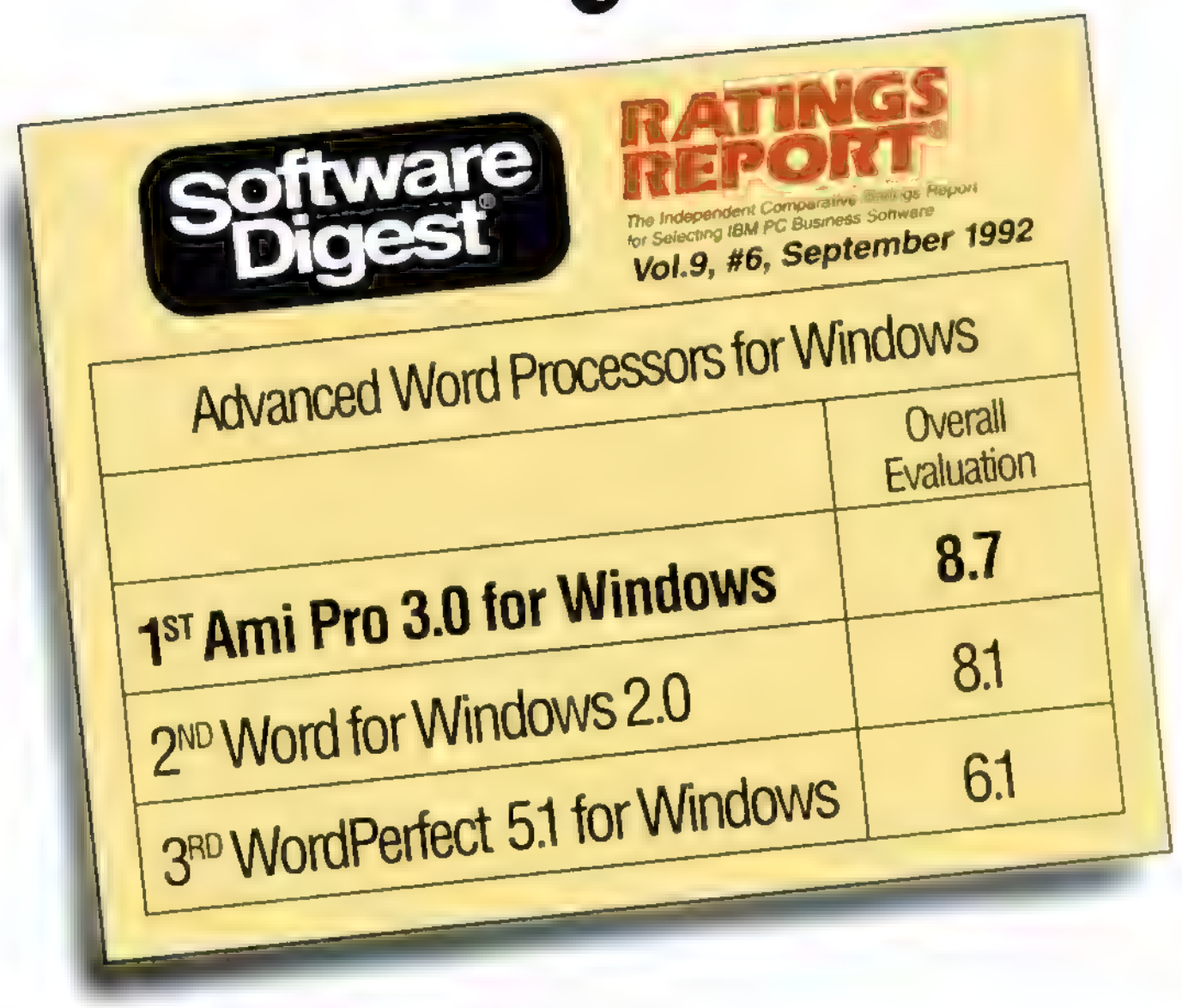


This ISA system is easy to upgrade until you attempt to change speeds on the motherboard. The ZIF (zero-insertion-force) socket facilitates the upgrade somewhat, but the jumpers on the motherboard lie underneath the hard disk controller. The motherboard also has a controller integrated on it, so you can avoid this problem and avoid the added cost. The controller card in the last slot obscured the motherboard even more.

The Mylex motherboard had 8MB of RAM installed (with a system maximum of 64MB) and a 64K cache (expandable to 256K). Seven expansion slots (six 16-

They do.



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International Instrumentation's Blue Max Monolith

bit and one 8-bit) and five drive bays (two 5.25-inch and three 3.5-inch) are all the expansion the system offers. All devices are powered by a 250-watt power supply. The 213MB hard disk was coupled with a caching controller, and the video subsystem was a combination of a Diamond Stealth board with an S3 chip set and a 14-inch ViewSonic monitor.

In processor performance, the Blue Max was exceptional—at or near the top in each processor category (486SX/20, 486SX/25, 486/25, 486/33, 486DX2/50, and 486DX2/66). Its scores on our memory test were average, and the HyperStor caching controller helped turn in better-than-average disk performance. On our DOS-based video scores, it placed a little below the average, but true to form, the Stealth's S3 chip set performed well on the Graphics Winmark test.

The documentation covered all features of the system, but its duplicate of chapter 4 did confuse us initially. The company provides a one-year parts-and-labor warranty, plus free on-site service from TRW outside the company's 65-mile radius; within this distance, the company provides the service.—*WPF*

Keydata International Inc.

KEY486SX-25

At $2,095, Keydata International's KEY486SX-25 offers above-average performance at a reasonable price. Upgrading it isn't easy by any means, but at this price it makes economic sense to start at the top—a 486DX2/50—for $2,470.

In theory, upgrading involves removing the chip with a standard chip puller, swapping out the clock crystal, and changing the jumper settings. The problem is that the CPU socket is located behind the power supply, requiring you to remove the motherboard. In fact, after you remove it, you also have to take out any full-length boards installed in slots 1, 2, or 3. This is not a machine that the average user would want to upgrade.

The motherboard has seven 16-bit expansion slots and one 32-bit proprietary memory slot. Two slots were taken up by the video card and a caching disk controller. Eight memory banks accommodate a maximum of 32MB of on-board RAM. The system arrived with 8MB of RAM, a 256K external cache, and a 212MB Maxtor IDE hard disk. Keydata paired an S3 chip–based video adapter made by GUI with a 14-inch monitor that delivers 1,024-by-768 noninterlaced resolution at a 70-Hz refresh rate. Included are DOS 5.0, Microsoft Windows 3.1, a Logitech mouse, and the choice of one of five popular software programs.

We tested the Keydata with 486SX/25, 486DX/25, 486DX/33, and 486DX2/50 processors. It registered average performance on the processor, disk, and Graphics Winmark tests. Its S3 chip set produced disappointing DOS-based video test results.

The documentation consisted of manuals relating to each component (video, disk controller, motherboard, and monitor) neatly organized in a binder. The motherboard documents do an excellent job of explaining the jumper settings, both in text and diagrams. Keydata also offers a better-than-average warranty: 18 months on parts and labor, with on-site service from Wang included the first year (the company is presently negotiating with other contractors).—*WPF*

FACT FILE

KEY486SX-25

Keydata International Inc., 111 Corporate Blvd., South Plainfield, NJ 07080; 800-486-4800, 908-755-0350; fax, 908-756-7359

List price (tested configuration): 486SX/25, $2,095, 486DX/25 upgrade, $180; 486/33 upgrade, $250, 486DX2/50 upgrade, $375

Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K cache

Disk drives and controller: Maxtor 7213AT 212MB IDE hard disk with 64K buffer, Chicony 16-bit controller with 1MB RAM, 1.2MB and 1.44MB floppy disk drives.

Display: GUI S3C911 video adapter with 1MB VRAM, CTX CVP-5468NI 14-inch monitor, 70-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1, choice of GeoWorks Ensemble, Norton Desktop for Windows, PFS Winworks, Quattro Pro, or SideKick

In short: The KEY486SX-25 was an average or better performer but has a difficult upgrade. You may as well buy the $2,470 486DX2/50 version.

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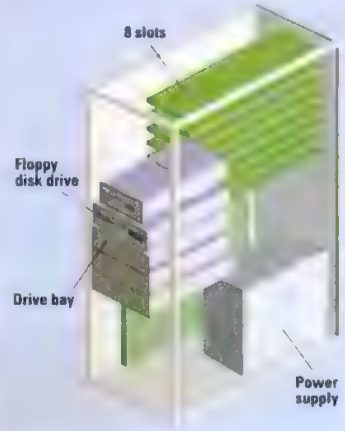

The KEY486SX-25

Lightning Computers

Lightning Omniflex 486

The $1,695 Lightning Omniflex 486 is one of those machines that received an Editors' Choice award in our October 13, 1992, review of 486SX/25 systems. It offered not only a surprisingly good configuration and competitive performance, but also a price about $1,000 less than that of some of its competitors. Against the upgradable machines seen here, the Omniflex still manages to hold its own.

Upgrading involves an easy ZIF (zero-insertion-force) chip replacement, then switching the clock crystal, which has a

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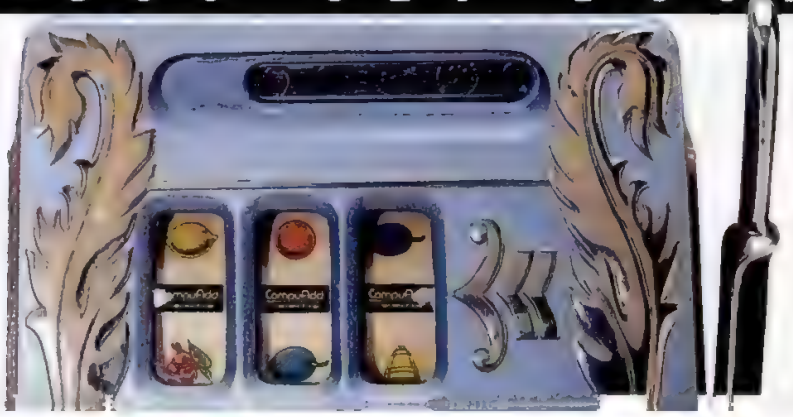

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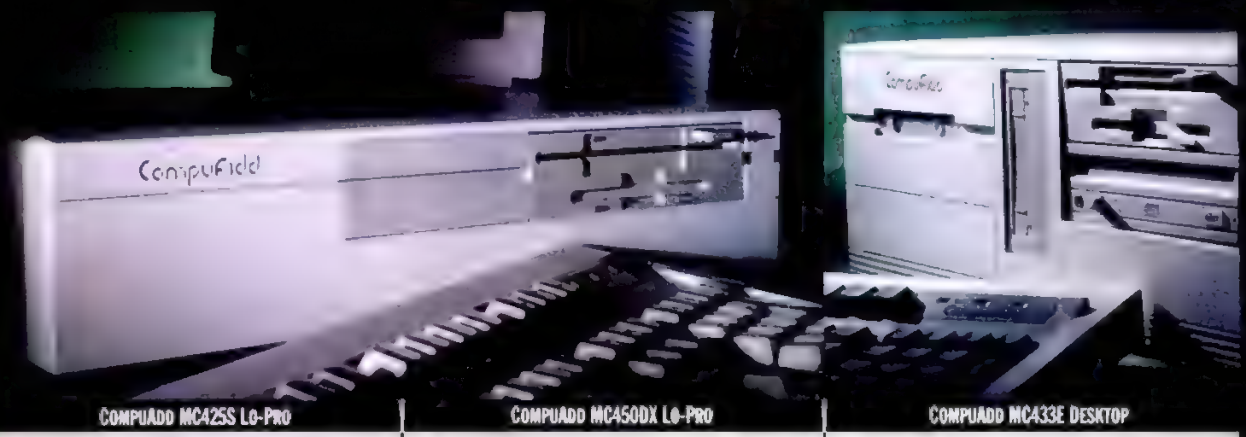

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IDE on-board adapter

Accelerated ISA-bus video adapter (supports up to 1024x768, 256 colors, @72Hz)

ATI Ultra-Pro local-bus video accelerator card upgrade (20 million+ WINmark performance)

14" VGA color monitor, non-interlaced (15", 17" available)

MS-DOS and Windows 3.1 preloaded
Novell, LAN Man and UNIX certified

Network board options include NDC Token Ring or Ethernet, SMC 8013 Ethernet, Intel EISA, Proteon EISA

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Optional hard drive: 1.2GB

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EISA-based motherboard

Dual floppy drives (3.5" and 5.25")

Bus master EISA SCSI controller

Accelerated ISA-bus video adapter (supports up to 1024x768, 256 colors, @72Hz)

ATI Ultra-Pro local-bus video accelerator card upgrade (20 million+ WINmark performance)

14" VGA color monitor, non-interlaced (15", 17" available)

Optional Wangtech 51000ES 1GB tape drive

MS-DOS and Windows 3.1 preloaded
Novell, LAN Man and UNIX certified

Network board options include Proteon EISA Token Ring, or Intel EISA Ethernet or SMC 8013 Ethernet

One-year free onsite service

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COMPUADD MC466EDX TOWER

A floor-standing network server chassis

*Features an Intel486DX2 microprocessor bringing you 66MHz performance using Intel's speed-doubling technology

1.2GB SCSI-2 hard drive
10MB/sec SCSI transfer rate

32MB RAM upgradeable to 64MB

EISA-based motherboard

Dual floppy drives (3.5" and 5.25")

Bus master EISA SCSI controller

Accelerated ISA-bus video adapter (supports up to 1024x768, 256 colors, @72Hz)

ATI Ultra-Pro local-bus video accelerator card upgrade (20 million+ WINmark performance)

14" VGA color monitor, non-interlaced (15", 17" available)

Optional Wangtech 51000ES 1GB tape drive

MS-DOS and Windows 3.1 preloaded
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Network board options include Proteon EISA Token Ring, or Intel EISA Ethernet or SMC 8013 Ethernet

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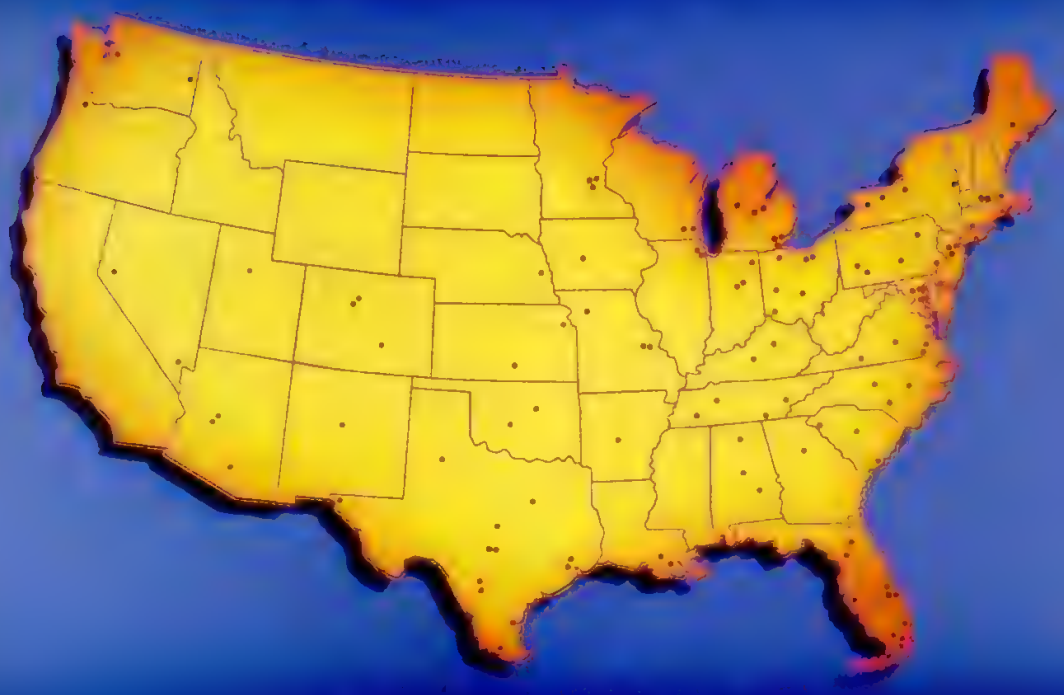

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tie-wrap to hold it in place, via an upgradable oscillator socket. The drive bays block easy access to the memory chips, but the processor sockets are easy to reach. The documentation could have been better organized, but everything is clearly explained once you find the proper section.

We tested the Omniflex with a 486SX/25, 486DX/25, 486DX/33, 486DX2/50, 486DX/50, and 486DX2/66 processor, and it performed competitively with all of them. Memory times were exceptionally speedy, probably due to the 60-nanosecond DRAM chips. The Quantum ProDrive LPS 240MB IDE hard disk with its 256K cache held its ground but didn't distinguish itself. The ATI Graphics Ultra video adapter presented below-average DOS-based video scores but made it into the upper percentile under Windows, due to its Mach 8 GUI accelerator.

The Lightning Omniflex 486

Lightning backs its product with an attractive two-year parts-and-labor warranty and toll-free technical support. First-year on-site service is available through Integrated Automation International for an additional $100. All in all, this system is still hard to beat.—*OR*

FACT FILE

Lightning Omniflex 486

Lightning Computers, 340 Brannan St. #200, San Francisco, CA 94107; 800-347-4486, 415-543-3111; fax, 415-543-3532

List price (tested configuration): 486SX/25, $1,695, 486DX/25 upgrade, $180, 486DX/33 upgrade, $220, 486DX2/50 upgrade, $375, 486DX/50 upgrade, $445, 486DX2/66 upgrade, $650

Memory and processor RAM cache: 8MB 60-ns SIMMs, 64K cache

Disk drives and controller: Quantum ProDrive LPS 240AT 240MB IDE hard disk, AMI and HyQuest disk controller integrated onto motherboard with 256K cache, 1 2MB and 1 44MB floppy disk drives

Display: ATI Graphics Ultra video adapter with Mach 8 accelerator and 1MB of video DRAM, ViewSonic 6 monitor, 60-Hz refresh rate at 1,024-by-768

Software: DOS 5 0, Microsoft Windows 3 1

In short: A former Editors' Choice winner (October 13, 1992), the Lightning Omniflex 486 does not excel quite as much as a dedicated upgradable, but it is still a serious entry-level contender

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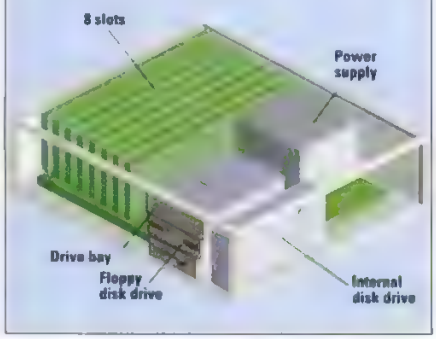

Lightning Computers

Lightning Omnicache 486E

The $2,125 486SX/25 Lightning Omnicache 486E is the EISA big brother of the Lightning Omniflex 486 (also reviewed here). Again the strong Lightning traits are all here: a low price, a fully equipped system, and standard performance. But when it comes to upgrading, Lightning Computers' approach is not detailed enough to make this PC anything more than a low-priced alternative.

The standard desktop case places two accessible 5.25-inch drive bays above one of the two 3.5-inch bays; two 5.25-inch bays are internal.

The Tyan-made EISA motherboard uses an OPTi chip set and runs with an AMI BIOS. It holds a 256K cache, ZIF (zero-insertion-force) and Weitek sockets, and eight EISA expansion slots, five of which were empty. You can expand the 8MB of 60-nanosecond RAM to 128MB on-board, though Lightning says it is now shipping a full-size version of this motherboard that can carry 256MB in 16MB SIMMs. An 8-bit I/O card occupies the last EISA slot and runs the extra ports through the punch-out openings in the case's rear—a strategy that may waste an EISA slot, but for this kind of money you can't expect everything. An UltraStor SCSI controller with a 32K cache handles the Seagate 248MB SCSI-2 hard disk. An ATI Graphics Ultra card with the Mach 8 GUI accelerator and 1MB of video DRAM take care of video, which is displayed on a 14-inch ViewSonic monitor.

FACT FILE

Lightning Omnicache 486E

Lightning Computers, 340 Brannan St., #200, San Francisco, CA 94107; 800-347-4486, 415-543-3111; fax, 415-543-3532

List price (tested configuration): 486SX/25, $2,125, 486DX/25 upgrade, $180, 486DX/33 upgrade, $320, 486DX2/50 upgrade, $375, 486DX/50 upgrade, $445, 486DX2/66 upgrade, $650

Memory and processor RAM cache: 8MB 60-ns SIMMs, 256K cache

Disk drives and controller: Seagate ST 3283N 248MB SCSI-2 hard disk, UltraStor 24F controller with 32K cache, 1 2MB and 1 44MB floppy disk drives

Display: ATI Graphics Ultra video adapter with Mach 8 accelerator and 1MB of video DRAM, ViewSonic 6E 14-inch monitor, 60-Hz refresh rate at 1,024-by-768

Software: DOS 5 0, Microsoft Windows 3 1

In short: An excellent choice for people who need performance on a budget, the Lightning Omnicache 486E is average in terms of upgradability ease

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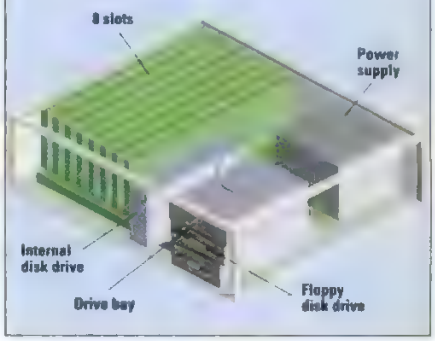

The Lightning Omnicache 486E

▶ BENCHMARK TESTS

Upgradable PCs: What Our New Performance Numbers Mean

With this issue, we introduce PC Magazine Labs' new Hardware Benchmark Tests, Release 7.0, and Windows Benchmark Tests (Winbench), Release 3.1, for a more realistic representation of how systems can handle today's complex computing environments. Details on the new tests can be found in the Lab Notes column in this issue, and specific test descriptions can be found alongside the benchmark test results.

This issue also introduces a new measure of overall system performance under DOS: the DOSmark score, which is a composite of the four DOS benchmark test scores we publish for each unit. When looking at the results for the individual component tests, you may have trouble predicting how well a system would perform when processing typical DOS applications. Some systems, for instance, might have a high disk score but a low video score, or a high CPU score but a low disk score. The DOSmark score indicates performance across a broad range of DOS applications. It applies the strongest weighting to disk performance, followed by processor, memory, and video performance.

In general, disk and video performance scores were not sensitive to changes in processor levels; processor and memory scores were. The key factor is the 8-MHz AT bus, which continues to act as a bottleneck to DOS video performance in many systems. However, the maximum speed at which a single hard disk can access and transfer data is so slow that most 386 or 486 systems can handle the transfers easily. With the addition of local-bus video and hardware disk-caching controllers, bottlenecks are reduced.

The Graphics Winmark results were more sensitive to varying CPU levels than the DOS video tests were, possibly because of the level of calculations that Windows performs before sending data to the video adapter.

DOS PROCESSOR AND MEMORY

Our new DOS processor test routines provide an accurate measure of overall CPU performance. The suite includes small and medium instruction mixes and a floating-point test, but the latter is weighted low in the CPU performance score calculation.

The Compaq Deskpro M receives two awards for its processor scores: Ironically, it was both the fastest system we saw—scoring a whopping 17,580 processor operations per second in the DX2/66 category—and the slowest system in the entire tested group—managing only 3,512 operations per second in its 386DX/25 configuration. Other systems whose processors performed well include the units from Axik, International Instrumentation, Keydata, Lightning (the Omniflex 486), and Northgate.

With any particular non-clock-doubled CPU architecture, processor scores were fairly flat among all systems. The systems without a second-level cache—the AcerPower 386/SX, ALR PowerFlex Flyer, Dell 486 D Family, Dell 486 DE Family, and ZDS Z-Station 420Sn—performed somewhat slower than the pack at the various processor levels. For example, the noncached Dell 486 D Family with a 486SX/25 CPU performed about 5 percent below the average for the group, about 11 percent below the best score.

In clock-doubled systems, the effects of second-level cache become more significant: The Dell 486 D Family's processor score was 16 percent below the average in the DX2/50 category, or 27 percent below the best performer. Clock-doubled systems without second-level caches will take a performance hit. Intel recommends at least a 128K second-level cache to support its DX2/50 and DX2/66 chips.

Several systems performed slower than expected, among them the Deico Predator with a 486DX/50 processor. After replacing the motherboard, we still saw a lower-than-expected result. Across multiple processor levels, the Standard system performed slower than expected, even though it had a 256K second-level cache. A possible explanation is that its cache wait states are longer than normal, acting as a drag on throughput. Finally, both IBM units performed slower than expected at the DX2/50 processor level, and the NCR was below average at the DX2/66 level. The IBM and NCR machines have at least 256K of second-level cache.

Memory test results tended to correlate with increased processor speed, with the exception of the clock-doubled systems. A 486DX2/50 will perform memory operations noticeably slower than a true 486DX/50 because the external memory is running at half the speed of the processor.

DOS VIDEO

The DOS video scores were fairly insensitive to processor upgrades on individual systems, with the exception of the local-bus designs. The video scores did vary greatly among different systems, depending on which video chip set was installed. As in the past, the Tseng chip–based systems continue to dominate DOS video performance.

Local-bus video subsystems in the CompuAdd, Micro Express (the ME 486-Local Bus), National Micro, NEC, and Wyse all use the Tseng ET4000 video circuitry, and they all provide excellent DOS video scores. The local-bus designs of the Comtrade, Mitsuba, Sirius, and Swan units had little impact on DOS video scores, probably because S3 chips can bottleneck the performance of the local bus.

Since our DOS-based video test routine performs direct video text and graphics writes as fast as possible, performance improvements of a properly implemented local-bus design are striking. In many of the tested local-bus systems, 486DX/33 chip levels outperform 486DX2/50 configurations, where the system bus runs at 25 MHz.

DOS DISK

Like the video scores, the DOS disk scores are somewhat insensitive to processor upgrades on any particular system, except in systems that use hardware caching disk controllers. Using a hardware cache in the I/O bus does speed up disk accesses because mechanical disk head movements are reduced significantly, making for more efficient bus operation.

A big gap separates the highest and lowest disk performers. The Mitsuba computer with a 486DX2/66 CPU had a score of 156.15 disk operations per second, in stark contrast to the Ariel unit's 486SX/25 score of 20.65 operations per second. Of the top ten disk subsystems, all used caching controllers. However, we believe a software-based disk cache will also have a positive impact on disk performance.

DOSMARK

When configured with a 486DX2/66 chip, Micro Express's MicroFLEX led the pack in overall DOS performance, with a DOSmark of 80.44. The Axik Ace Cache 486ALL! Series delivered the best overall DOS performance across a wide range of processor levels. Other notable finishers include the systems from Acer, Atlas, BOSS, Compaq (the Deskpro M), Diamond, International Instrumentation, Keydata, Lightning (the Omniflex 486), Mega, Mitsuba, and National Micro Systems. These products had three or more 486 configurations with a DOSmark score among the top ten within the same processor class.

Poor DOSmark scores were earned by the systems from Blue Star, Clover, CompuAdd, DFI, Everex, IBM (PS/2 Model 95), Lightning (Omnicache 486E), Standard, Swan, and Wyse.

GRAPHICS WINMARK

Compaq's proprietary QVision adapter continued to dazzle, allowing the 486DX2/66 Deskpro M to outperform its nearest competitor, the Mitsuba unit, by a 38 percent margin. Compaq continues to generate the best Graphics Winmark scores we have seen to date. Because of the changes in the tests, the new Winbench 3.1 Graphics Winmark testing results in scores lower than those of our older Graphics Winmark test (Winbench 2.5). As an indication, the Compaq Deskpro M with a 486DX2/66 processor and QVision video attained a Graphics Winmark of 12.30 megapixels per second using Winbench 3.1. In our review of DX2s (September 15), a 486DX2/50 Compaq Deskpro M scored 19.16.

The S3-based local-bus video, the DX2/66 Mitsuba and Swan systems were among those next in line, with Graphics Winmark scores of 8.94 and 8.45, respectively. A local bus does not add tremendous improvement to S3 chip–based video systems, because the current S3 chip is incapable of accepting large volumes of graphics data quickly from the local bus.

At 8.66, Diamond Technologies' upgradable unit was competitive with the Mitsuba and Swan; it is based on the SpeedSTAR 24X board that contains the new Western Digital WD90C31 graphics accelerator chip. The biggest surprise was the respectable 7.99 Graphics Winmark score for IBM's new high-speed XGA/2 adapter on a 486DX2/50 PS/2 Model 95.

Using the ATI Graphics Ultra card, the Standard, Axik, and Lightning (the Omniflex 486) systems had decent Graphics Winmark scores—between 7 and 8 million—for their 486DX2/66-level systems. As in the past, video systems based on the Tseng Labs ET4000 series and the older Western Digital Paradise chip sets turned in poor Graphics Winmark performance, but excellent DOS video scores.

ALR's video was generally disappointing. The three ALR units had subpar Graphics Winmark scores, although that was somewhat offset by better DOS video scores.

DISK WINMARK

The Windows software cache utility SmartDrive was installed in all systems for our Disk Winmark testing (SmartDrive is an integral part of Windows 3.1 installation). In contrast, we do not use software disk caching for our DOS disk tests. With SmartDrive caching in operation, the disk hardware subsystem is only part of the disk performance equation. CPU and memory speed affect disk operations because many disk requests are speeded by the SmartDrive software cache, which resides in system memory.

The 486DX2/66 Mitsuba Professional Upgradable system, which uses a Promise Technology 99M (an IDE caching adapter with 8.5MB cache RAM) along with a Maxtor 7213A (a 64K IDE drive), outperformed all other systems, with a Disk Winmark score of 85.01 operations per second. The DX2/66-based MicroFLEX also turned in an excellent score—81.77—using a 2MB UltraStor 15C (an ISA caching IDE adapter) and a Quantum ProDrive LPS 240 AT with a 256K on-board cache.

Interestingly, the Mitsuba unit reported the best Disk Winmark results for the high-end 486DX2/50, 486DX/50, and 486DX2/66 systems,while the International Instrumentation system performed best in the middle processor range (486SX/20, 486SX/25, 486DX/25, and 486DX/33). These results are possibly explained by the Mitsuba's 256K write-back second-level cache, compared with the International Instrumentation system's 64K of write-through processor cache. SmartDrive's impact was most evident with a combination of a fast processor and a large processor cache.

Typically, systems with caching adapters tend to cluster in the top third of the results on DOS disk testing, but the presence of SmartDrive caching tends to spread these systems out in terms of Disk Winmark scores. The IBM PS/2 Model 90 performed poorly, with a 22.41 Disk Winmark score in its most powerful, 486DX2/50 configuration. Both IBM units had SCSI adapters with less than 1MB of cache onboard.

Benchmark Tests: Upgradable PCs

After a close look at 48 systems designed for upgradability, the evidence shows that any weak link in terms of processor, video, or disk performance will doom a system to mediocrity.

HOW WE TESTED

In preparing this issue, for the first time we used PC Magazine Labs' new Hardware Benchmark Tests, Release 7.0, to predict PC processor, memory, video subsystem, and disk performance using DOS applications Each of the four scores we report is the weighted harmonic mean of the results from several tests, and are expressed in terms of throughput or operations per second. All of these results are summarized in a composite score called the DOSmark

We also used the new Windows Benchmark Tests (Winbench), Release 3.1, to obtain the Graphics Winmark and Disk Winmark scores, which predict the relative performance levels using popular Windows applications.

For more details on the benchmark tests, see Lab Notes in this issue.

The **processor** score is a measure of the CPU's performance and its interaction with cache and main memory. It is derived from tests that use small and medium-size instruction mixes, along with either the floating-point calculation test or the coprocessor test (depending on the presence or absence of a math coprocessor). The score indicates how well a computer's CPU and cache subsystems would execute common DOS and Windows applications

The **memory** score is compiled from 8-, 16-, and 32-bit extended-memory read and write tests, as well as 8- and 16-bit conventional-memory read and write tests Taken together, these tests reflect the throughput of a computer's main memory

The **video** score is based on direct-to-screen text-write and graphics-write tests. Taken together, these tests reflect the video throughput for a standard EGA/VGA adapter running DOS applications.

The **disk** score measures throughput using standard DOS INT 21h file I/O calls. The tests measure the speed of file reading and writing, both sequentially and randomly, for a range of file sizes from 256K to 32MB The tests are performed without software disk caches installed

The **DOSmark** score is a composite rating derived from the processor, memory, video, and disk test scores. The DOSmark indicates a computer system's ability to run DOS applications

The **Graphics Winmark** score is based on 12 Windows graphics and text functions derived from extensive profiling of popular Windows applications. It is measured in megapixels per second (a megapixel is 1,048,576 pixels)

The **Disk Winmark** score is based on testing techniques adapted from the DOS disk tests to reflect operations within the Windows environment For this portion of the testing, the systems were configured with up to 2MB of SmartDrive cache

Higher scores represent better performance.	**Processor** (operations per second)	**Memory** (kilobytes per second)	**Video** (thousands of operations per second)	**Disk** (kilobytes per second)	**DOSmark**	**Graphics Winmark** (megapixels per second)	**Disk Winmark** (kilobytes per second)
AcerPower 386/SX (Intel 486SX/25)	5,342	3,707	2,616	33.39	**25.16**	1 23	32 69
AcerPower 386/SX (Intel 486DX2/50)	7,590	4,952	2,617	34 59	**30.06**	1 35	37.61
AcerPower 486/SX (Intel 486SX/20)	5,313	3,221	1,742	56 14	**29 78**	1 21	27 09
AcerPower 486/SX (Intel 486SX/25)	6,717	4,057	2,239	63.32	**36.19**	1.79	31 44
AcerPower 486/SX (Intel 486DX/33)	8,923	5,344	2,512	67 96	**44.15**	2 03	34 24
AcerPower 486/SX (Intel 486DX2/50)	11,879	6,836	2,235	71 44	**52.32**	2 28	36 87
ALR Flyer 32DT (Intel 486SX/25)	6,360	4,381	4,077	29 80	**25 90**	1 08	29 41
ALR Flyer 32DT (Intel 486DX/33)	7 917	5,619	4,520	30 42	**28 94**	1 41	30 57
ALR Flyer 32DT (Intel 486DX2/50)	10,461	7,753	4,088	31 07	**32.70**	1 49	32 58
ALR Flyer 32LCT (Intel 486SX/25)	6,357	4,381	4,076	29 86	**25 93**	1 07	31 18
ALR Flyer 32LCT (Intel 486DX/33)	7,917	5,619	4,520	31 79	**29.70**	1.41	32.77
ALR Flyer 32LCT (Intel 486DX2/50)	10,430	7,753	4,084	30 75	**32.45**	1 48	33 79
ALR PowerFlex Flyer (Intel 486SX/20)	4,158	2,622	2,844	25 65	**19.13**	0 42	26 15
ALR PowerFlex Flyer (Intel 486SX/25)	5,216	3,283	3,067	25 58	**21.41**	0 49	29 41
Ariel 486SX/25 (Intel 486SX/25)	6 906	3,808	1,715	20 65	**20 75**	4 81	32 96
Ariel 486SX/25 (Intel 486SX/25 OverDrive)	12,829	5,400	1,724	20 57	**24.14**	6 20	37 50
AST Power Premium (Intel 386DX/33)	4,914	4,448	5,462	34 11	**25.60**	3 02	29 68
AST Power Premium (Intel 486SX/25)	6,738	3,511	4,210	28 74	**24.76**	3 68	34.85
AST Power Premium (Intel 486DX/33)	8,945	4,244	4,827	28 51	**27.35**	4 50	36 71
AST Power Premium (Intel 486DX2/50)	11,196	3,520	4,191	31 90	**29 34**	4 97	39 11
Atlas ProNet 486UX Series (Intel 486SX/25)	6,762	3,590	1,240	84 64	**38.07**	3 78	31.39
Atlas ProNet 486UX Series (Intel 486DX/33)	9,080	4,773	1,338	96 25	**48.28**	4 78	34 01
Atlas ProNet 486UX Series (Intel 486DX2/50)	10,587	4,326	1,232	98 47	**49 65**	4 70	34 40
Atlas ProNet 486UX Series (Intel 486DX/50)	13,266	7,364	1,364	109 69	**65.10**	5 81	37 63
ATronics ATI-B2 Series (Intel 486SX/20)	5,412	2,329	1,649	27 22	**20 60**	3 97	28 69
ATronics ATI-B2 Series (Intel 486SX/25)	6,784	3,171	1,704	28 04	**23 82**	4 86	32 79
ATronics ATI-B2 Series (Intel 486DX/33)	8,789	3,851	1,760	29 25	**26 96**	4 98	35 17
ATronics ATI-B2 Series (Intel 486DX2/50)	11,940	3,801	1,704	28 80	**28 22**	5 66	37 51
ATronics ATI-B2 Series (Intel 486DX/50)	13 262	5 420	1,826	28 97	**30 83**	6 07	39 21
Axik Ace Cache 486ALL! Series (Intel 486SX/20)	5,504	3,038	2,207	93 12	**34.28**	3 61	29 22
Axik Ace Cache 486ALL! Series (Intel 486SX/25)	6,906	3,805	2,518	102 63	**41.62**	4 40	30 62
Axik Ace Cache 486ALL! Series (Intel 486DX/25)	7,012	3,809	2,517	104 07	**42 05**	4 46	30 78

CONTINUES

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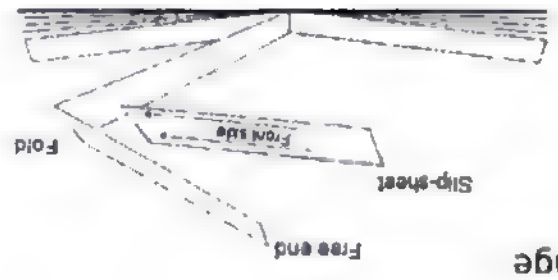

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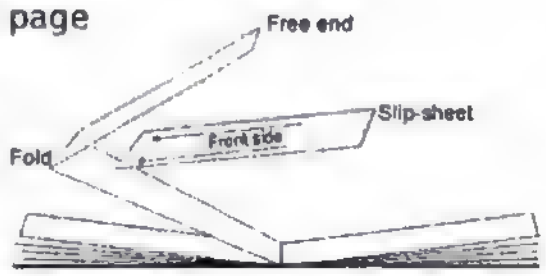

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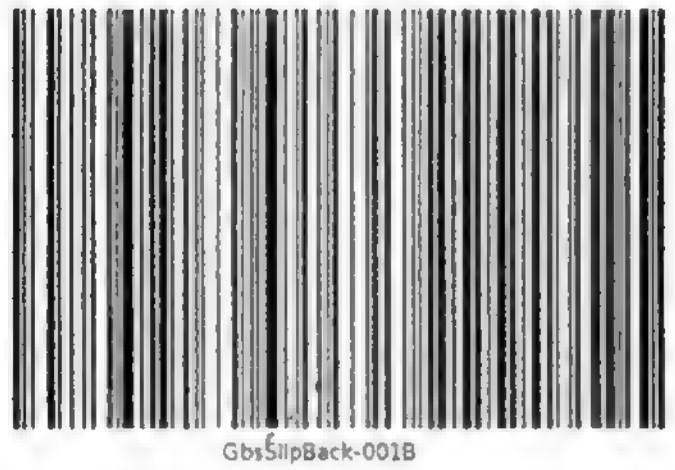

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PC Sources, August 1992

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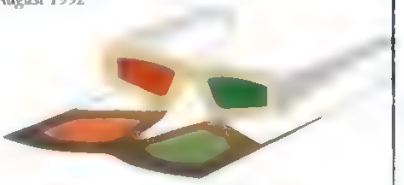

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Benchmark Tests: Upgradable PCs

Higher scores represent better performance	Processor (operations per second)	Memory (kilobytes per second)	Video (thousands of operations per second)	Disk (kilobytes per second)	DOSmark	Graphics Winmark (megapixels per second)	Disk Winmark (kilobytes per second)
Axik Ace Cache 486ALL! Series (Intel 486DX/33)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Axik Ace Cache 486ALL! Series (Intel 486DX2/50)	12,950	6,018	2,523	125 50	64 88	6 10	34 31
Axik Ace Cache 486ALL! Series (Intel 486DX/50)	13,688	7,000	2,990	128 73	70.01	6 60	37 12
Axik Ace Cache 486ALL! Series (Intel 486DX2/66)	16,403	6,716	2,689	133 70	74 30	7 10	37 86
Blue Star Upgradable (Intel 386DX/33)	5,162	2,783	1,730	26 33	20 87	4 95	27 53
Blue Star Upgradable (AMD 386DX/40)	6 223	3,258	1,762	27 39	23 16	5 39	29 28
Blue Star Upgradable (Intel 486SX/20)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26 79
Blue Star Upgradable (Intel 486SX/25)	6,763	2,708	1,683	27 94	22 91	4 64	30 17
Blue Star Upgradable (Intel 486DX/33)	8 886	3,118	1,733	28 76	25 56	5 22	32 54
Blue Star Upgradable (Intel 486DX2/50)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Blue Star Upgradable (Intel 486DX/50)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BOSS CEO (AMD 386DX/40)	5,502	3,249	1,510	85 02	34 08	4 64	33 28
BOSS CEO (Intel 486SX/20)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
BOSS CEO (Intel 486DX/33)	9,333	4,836	1,693	116 84	52 14	4 98	39 61
BOSS CEO (Intel 486DX/50)	13 391	6,018	1,631	121 33	64 27	5 56	43 65
Clover 486 I Series (Intel 486SX/25)	6,794	3,490	1,363	26 68	23 60	3 34	27 90
Clover 486-I Series (Intel 486DX/33)	9,261	4,676	1,564	27 73	27 33	4 23	32 35
Clover 486 I Series (Intel 486DX2/50	11,920	4 247	1,435	28 35	29 52	4 81	33 60
Clover 486-I Series (Intel 486DX/50)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Clover 486-I Series (Intel 486DX2/66)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Club Falcon 325 (Intel 386DX/25)	3,611	2,518	3,035	31 49	19 70	1 21	24 20
Club Falcon 325 (Intel 386DX/33)	4,903	3,424	4,080	34 09	24 34	1 63	30 09
Club Falcon 325 (AMD 386DX/40)	5,957	4,143	4,586	35 60	27 55	2 00	30 48
Club Falcon 325 (Intel 486DX/33)	9,235	3,965	4,217	37 42	31 63	2 79	36 39
Club Falcon 325 (Intel 486DX2/50)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Compaq Deskpro I (Intel 386DX/25)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Compaq Deskpro I (Intel 386DX/33)	4,976	4,412	4,771	26 29	22 54	4 87	[illegible]
Compaq Deskpro I (Intel 486SX/25)	6,807	4,266	4,707	28 19	25 49	6 06	28 01
Compaq Deskpro I (Intel 486DX/33)	9,152	5,627	4,806	29 20	29 24	7 36	29 90
Compaq Deskpro M (Intel 386DX/25)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Compaq Deskpro M (Intel 386DX/33)	[illegible]	4,412	6,046	34 96	24.98	5 11	36 20
Compaq Deskpro M (Intel 486SX/16)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34 70
Compaq Deskpro M (Intel 486SX/25)	6,178	4,266	5,982	36 21	28 28	6 52	38 94
Compaq Deskpro M (Intel 486DX/33)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Compaq Deskpro M (Intel 486DX2/50)	13,169	6,499	5,995	38 03	38 15	10 49	43 14
Compaq Deskpro M (Intel 486DX2/66)	17,580	8,457	6,163	36 97	41 12	12 30	44 72
CompuAdd Scalable Systems (AMD 386DX/40)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24 54
CompuAdd Scalable Systems (Intel 486SX/25)	6,581	2,864	7,803	26 92	22 80	2 19	25 84
CompuAdd Scalable Systems (Cyrix 486DLC/33)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CompuAdd Scalable Systems (Intel 486DX/33)	8,978	3,506	9,535	28 48	26 38	2 95	27 34
CompuAdd Scalable Systems (Intel 486DX2/50)	11 158	3,377	8,020	25 86	25 69	3 83	28.34
Comtrade 486 Local Bus Win-Station (Intel 486SX/25)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Comtrade 486 Local Bus Win-Station (Intel 486DX/33)	9,106	3,423	1,544	31 82	27 71	5 37	36 78
Comtrade 486 Local Bus Win-Station (Intel 486DX2/50)	11,843	3,585	1,538	33 69	30 44	6 25	38 88
Comtrade 486 Local Bus Win-Stat on (Intel 486DX/50)	13,633	5,129	1,683	33 36	33 56	6 40	37 63
Comtrade 486 Local Bus Win-Stat on (Intel 486DX2/66)	15,771	4,758	1,624	34 55	34 58	7 52	41 00
CUBE ATX Upgradable System (AMD 386DX/40)	6,043	4,898	1,718	26 82	24 36	4 87	26 18
CUBE ATX Upgradable System (Intel 486SX/25)	6,690	5,051	1,617	27 43	25 47	4 13	27 19
CUBE ATX Upgradable System (Intel 486DX/33)	9,122	5,054	1,656	28 13	27 86	5 01	29 36
CUBE ATX Upgradable System (Intel 486DX/50)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CUBE ATX Upgradable System (Intel 486DX2/66)	15 972	8 142	1,733	30 24	34 62	6 78	33 00
Deico Predator (Intel 386DX/33)	4,954	4,006	4,067	32 31	24 56	1 67	33 80
Deico Predator (AMD 386DX/40)	5,746	4,764	3,615	31 78	26 34	1 74	35 69
Deico Predator (Intel 486SX/25)	6,130	3,954	3,678	32 70	26 39	2 04	38 32
Deico Predator (Cyrix 486DLC/33)	5,851	4,720	3,735	33 15	27 03	1 84	36 14
Deico Predator (Intel 486DX/33)	8,365	5,267	3,717	33 63	30 76	2 44	41 84
Deico Predator (Intel 486DX2/50)	10,340	6,364	3,686	36 76	35 22	2 54	44 49
Deico Predator (Intel 486DX/50)	10,560	6,380	3,717	36 49	35 25	2.39	44 41
Deico Predator (Intel 486DX2/66)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dell 486 D Family (Intel 486SX/25)	6,166	4,250	4,082	36 12	28 17	1 06	28 58
Dell 486 D Family (Intel 486DX/33)	8,089	5,631	4,437	37 36	32.72	1 39	32 71
Dell 486 D Family (Intel 486DX2/50)	9,594	6 008	4,088	38 14	35 02	1 54	34 28
Dell 486 D Family (Intel 486DX2/66)	[illegible]	7,955	4,437	38 34	38 70	1 78	37.15

CONTINUES

Benchmark Tests: Upgradable PCs

Higher scores represent better performance

	Processor (operations per second)	Memory (kilobytes per second)	Video (thousands of pixels per second)	Disk (kilobytes per second)	DOSmark	Graphics Winmark (megapixels per second)	Disk Winmark (kilobytes per second)
Dell 486 DE Family (Intel 486SX 25)	6 47[illegible]	4 5[illegible]5	4 389	9[illegible]4	29 2[illegible]	1 71	37 15
Dell 486 DE Family (Intel 486DX 33)	9 [illegible]6[illegible]	5 [illegible]2	1 864	[illegible]6 19	34 52	2 [illegible]3	38 75
Dell 486 DE Family (Intel 486DX2 50)	1[illegible]38	6 5[illegible]9	4 497	35 46	36 86	2 32	4[illegible]55
Dell 486 DE Family (Intel 486DX 50)	13 6[illegible]3	[illegible]6[illegible]5	4 392	39 29	40 21	2 55	45 23
DFI Diamond Series Model 333D (Intel 386DX 33)	5 15[illegible]	3 [illegible]8[illegible]	6 [illegible]39	24 9[illegible]	20 98	1 77	19 93
DFI Diamond Series Model 333D (Intel 486SX 25)	5 41[illegible]	2 44[illegible]	6 425	25 [illegible]9	20 7[illegible]	1 74	25 75
DFI Diamond Series Model 333D (Intel 486SX 25)	6 78[illegible]	4 [illegible]69	7 717	2[illegible]7	23 [illegible]9	2 19	29 97
DFI Diamond Series Model 333D (Intel 486DX 33)	9 795	4 61[illegible]	6 765	29 [illegible]1	26 50	2 89	32 29
DFI Diamond Series Model 333D (Intel 486DX2 50)	11 81[illegible]	4 [illegible]6	7 56[illegible]	2[illegible]5[illegible]	27 10	3 86	35 50
Diamond DT486EX (Intel 486SX 25)	6 911	4 [illegible]22	3 734	1[illegible]8 95	39 34	5 34	41 53
Diamond DT486EX (Intel 486DX 25)	6 67[illegible]	4 [illegible]3	3 754	1[illegible]7 84	38 69	5 34	4[illegible]45
Diamond DT486EX (Intel 486DX 33)	8 82[illegible]	3 9[illegible]2	4 [illegible]97	2[illegible]6 [illegible]	49 [illegible]2	6 56	44 58
Diamond DT486EX (Intel 486DX2 50)	11 138	3 4[illegible]3	3 [illegible]75	1[illegible]4 68	51 40	8 [illegible]7	46 87
Diamond DT486EX (Intel 486DX 50)	13 [illegible]01	5 [illegible]45	4 [illegible]28	1[illegible]8 17	67 37	8 [illegible]08	46 80
Diamond DT486EX (Intel 486DX2 66)	14 [illegible]46	4 4[illegible]9	3 333	1[illegible]4 86	65 2[illegible]	8 [illegible]82	4[illegible]75
Everex Tempo M Series (Intel 486DX 33)	5 [illegible]2	4 [illegible]60	4 739	26 05	22 59	1 58	28 94
Everex Tempo M Series (Intel 486SX 20)	5 [illegible]0[illegible]	3 [illegible]80	2 [illegible]10[illegible]	2[illegible]3[illegible]	20 6[illegible]	1 [illegible]68	24 94
Everex Tempo M Series (Intel 486SX 25)	6 [illegible]35	4 [illegible]1[illegible]	3 41[illegible]0	24 67	23 47	2 [illegible]61	32 33
Everex Tempo M Series (Intel 486DX 33)	9 [illegible]46	[illegible]4[illegible]0	5 [illegible]66	3[illegible]6 46	27 52	2 [illegible]72	35 2[illegible]
Everex Tempo M Series (Intel 486DX2 50)	12 [illegible]00	5 [illegible]66	4 [illegible]71	25 [illegible]5	27 85	2 58	36 68
IBM PS/2 Model 90 (Intel 486SX 25)	6 283	4 54[illegible]	3 [illegible]42	22 99	23 33	6 78	20 66
IBM PS/2 Model 90 (Intel 486DX 33)	8 [illegible]2[illegible]	5 [illegible]60	[illegible] 44	2[illegible]4[illegible]	2[illegible]5[illegible]	1 [illegible]50	31 3[illegible]
IBM PS/2 Model 90 (Intel 486DX2 50)	10 [illegible]8[illegible]	6 [illegible]66	5 [illegible]16	2[illegible]5 [illegible]	27 71	2 69	2[illegible]41
IBM PS/2 Model 95 (Intel 486SX 25)	6 231	4 54[illegible]	3 [illegible]44	[illegible]4 [illegible]9	28 94	6 8[illegible]	34 [illegible]9
IBM PS/2 Model 95 (Intel 486DX 33)	8 41[illegible]5	5 [illegible]2[illegible]	3 [illegible]96	3[illegible]5 [illegible]7	3[illegible] 56	2 54	3[illegible]26
IBM PS/2 Model 95 (Intel 486DX2 50)	11 11[illegible]4	6 [illegible]66	5 [illegible]82	3[illegible]2 [illegible]0	36 01	7 99	35 95
Intel Inside Blue Max Mainstream (Intel 486SX 20)	5 5[illegible]7	2 8[illegible]2	1 [illegible]28	59 85	29 86	3 92	44 32
Intel Inside Blue Max Mainstream (Intel 486SX 25)	6 9[illegible]8	[illegible] 9[illegible]1	[illegible] 764	[illegible] [illegible]	3[illegible]5[illegible]	4 46	49 64
Intel Inside Blue Max Mainstream (Intel 486DX 25)	7 [illegible]0	5 [illegible]9[illegible]	[illegible] [illegible]6[illegible]	[illegible]9 [illegible]9	36 58	4 47	49 72
Intel Inside Blue Max Mainstream (Intel 486DX 33)	9 [illegible]09	4 76[illegible]	[illegible] 804	8[illegible]9[illegible]	46 6[illegible]	4 89	5[illegible]47
Intel Inside Blue Max Mainstream (Intel 486DX2 50)	[illegible]1 [illegible]46	4 [illegible]06	[illegible] [illegible]6[illegible]	[illegible]3 53	46 [illegible]4	5 35	65 [illegible]0
Intel Inside Blue Max Mainstream (Intel 486DX2 66)	[illegible]7 [illegible]71	5 [illegible]33	[illegible] 804	98 95	50 58	5 56	73 84
KE+486SX (Intel 486SX 25)	6 [illegible]45	4 [illegible]8[illegible]	[illegible] [illegible]3[illegible]	[illegible]6 [illegible]8	[illegible]9[illegible]	4 [illegible]01	3[illegible]57
KE+486SX (Intel 486DX 25)	[illegible] [illegible]0[illegible]	4 [illegible]7[illegible]	[illegible] [illegible]46	55 [illegible]6	[illegible] [illegible]25	3 56	5[illegible]80
KE+486SX (Intel 486DX 33)	[illegible]8 39[illegible]	[illegible]5[illegible]7	[illegible] [illegible]7[illegible]	[illegible]0[illegible]	[illegible]4 [illegible]8[illegible]	4 [illegible]15	35 [illegible]7
KE+486SX (Intel 486DX2 50)	[illegible]2 [illegible]94	[illegible]6[illegible]5	[illegible] [illegible]4[illegible]	63 [illegible]8	51 [illegible]5	4 65	37 67
Lightning Impact (Intel 486SX 25)	6 446	[illegible]2 [illegible]96	[illegible] [illegible]3[illegible]	[illegible]4 [illegible]4[illegible]	[illegible]4 09	4 23	3[illegible]56
Lightning Impact (Intel 486DX 25)	[illegible]5 [illegible]7	[illegible]3[illegible]7	[illegible] [illegible]1[illegible]	[illegible] [illegible]2[illegible]	[illegible]3 61	1 21	3[illegible]35
Lightning Impact (Intel 486DX 33)	[illegible]8 [illegible]1[illegible]	[illegible]4[illegible]2	[illegible] [illegible]4[illegible]	[illegible]2 [illegible]8[illegible]	[illegible]7 26	5 15	39 46
Lightning Impact (Intel 486DX2 50)	[illegible]7 [illegible]57	[illegible]4 [illegible]9	[illegible] [illegible]1[illegible]	[illegible]2 [illegible]8	[illegible]8 [illegible]5	[illegible]7 [illegible]7	3[illegible]97
Lightning Impact (Intel 486DX2 66)	[illegible]1 [illegible]49[illegible]	[illegible]5 [illegible]3	[illegible] [illegible]2[illegible]	[illegible]2 [illegible]8	3[illegible]01	6 24	45 38
Lightning Impact 486 (Intel 486SX 25)	[illegible]4 [illegible]2	[illegible]4 [illegible]3	[illegible] [illegible]1[illegible]	[illegible]1 [illegible]4	31 62	6 71	4[illegible]78
Lightning Impact 486 (Intel 486SX 25 OverDrive)	[illegible]5 [illegible]4[illegible]	[illegible]4 [illegible]3	[illegible] [illegible]2[illegible]	[illegible]1 [illegible]4	27 56	4 [illegible]2[illegible]	1[illegible]88
Lightning Impact 486 (Intel 486DX 25)	[illegible]3 [illegible]7[illegible]	[illegible]5 [illegible]5[illegible]	[illegible] [illegible]6[illegible]	[illegible]7 [illegible]8[illegible]	39 [illegible]0	6 [illegible]0[illegible]	2[illegible]51
Lightning Impact 486 (Intel 486DX 33)	[illegible]1 [illegible]46	[illegible]4 [illegible]4[illegible]	[illegible] [illegible]2[illegible]	[illegible]3 [illegible]0[illegible]	28 09	4 [illegible]2[illegible]	19 [illegible]1
Lightning Impact 486 (Intel 486DX2 50)	[illegible]4 [illegible]4[illegible]	[illegible]5 [illegible]5[illegible]	[illegible] [illegible]2[illegible]	[illegible]4 [illegible]4	32 91	5 15	21 69
Lightning Impact 486 (Intel 486DX2 50)	[illegible]1 [illegible]365	[illegible]1 [illegible]7[illegible]	[illegible] [illegible]1[illegible]	[illegible]2 [illegible]6[illegible]	33 11	5 98	21 12
Lightning Impact 486 (Intel 486DX2 66)	[illegible]4 [illegible]43	[illegible]7 [illegible]2[illegible]	[illegible] [illegible]4[illegible]	[illegible]2 [illegible]4	37 65	6 39	23 14
Lightning Impact 486 (Intel 486DX2 66)	[illegible]7 [illegible]457	[illegible]8 [illegible]47[illegible]	2 [illegible]460	[illegible]9 [illegible]2	41 53	6 92	23 04
Mega Impact (Intel 486SX 25)	6 [illegible]2[illegible]7	3 [illegible]971	1 [illegible]236	6[illegible] [illegible]8	34 22	4 68	39 56
Mega Impact (Intel 486DX 33)	8 [illegible]14	[illegible]5 [illegible]98	[illegible] [illegible]270	[illegible]1 [illegible]9	44 84	5 13	44 45
Mega Impact (Intel 486DX2 50)	8 [illegible]54	6 [illegible]5[illegible]2	[illegible] [illegible]240	67 [illegible]4	46 23	5 86	44 45
Mega Impact (Intel 486DX 50)	[illegible]2 [illegible]43	[illegible]5 [illegible]4	[illegible] [illegible]22[illegible]	[illegible]2 [illegible]54	51 62	5 [illegible]7	46 8[illegible]
Mega Impact (Intel 486DX2 66)	12 [illegible]47	6 [illegible]6[illegible]8	1 [illegible]276	[illegible]1 [illegible]99	54 92	6 [illegible]8	4[illegible]26
Micro Express ME 486 Local Bus (Intel 486SX 25)	6 [illegible]60	4 [illegible]2[illegible]6	9 [illegible]16	[illegible]8 [illegible]1	[illegible]2 46	2 16	41 98
Micro Express ME 486 Local Bus (Intel 486DX 25)	[illegible]5 [illegible]46[illegible]	[illegible]3 [illegible]3[illegible]	[illegible] [illegible]1[illegible]	[illegible]2 [illegible]5[illegible]	27 60	2 16	31 83
Micro Express ME 486 Local Bus (Intel 486DX 33)	[illegible]1 [illegible]7[illegible]	[illegible]1 [illegible]7[illegible]	[illegible]0 [illegible]6[illegible]	[illegible]4 [illegible]5	[illegible]1 95	2 [illegible]8[illegible]	34 61
Micro Express ME 486 Local Bus (Intel 486DX2 50)	[illegible]1 [illegible]2[illegible]	[illegible]2 [illegible]2[illegible]	[illegible] [illegible]1[illegible]	[illegible]3 [illegible]7	34 3[illegible]	4 05	36 45
Micro Express ME 486 Local Bus (Intel 486DX2 66)	[illegible]6 [illegible]4[illegible]	[illegible]4 [illegible]0[illegible]	[illegible]1 [illegible]1[illegible]	[illegible]7 [illegible]3	37 43	3[illegible]04	5 59
Micro Express MicroFLEX (Intel 386DX 33)	[illegible]1 [illegible]70	[illegible]2 [illegible]7[illegible]	[illegible] [illegible]1[illegible]	[illegible]6 [illegible]6	[illegible]7 [illegible]7	4 [illegible]7	31 [illegible]3
Micro Express MicroFLEX (Intel 486DX 40)	[illegible]1 [illegible]7[illegible]	[illegible]3 [illegible]9[illegible]7	[illegible] [illegible]1[illegible]	[illegible]2 [illegible]4	[illegible]7 [illegible]8	4 [illegible]3[illegible]	33 6[illegible]
Micro Express MicroFLEX (Intel 486SX 25)	[illegible]1 [illegible]4	[illegible]2 [illegible]0[illegible]	[illegible] [illegible]2[illegible]	[illegible]2 [illegible]6	[illegible]2 [illegible]7[illegible]	[illegible]3 [illegible]69	42 [illegible]2
Micro Express MicroFLEX (Intel 486DX 25)	[illegible]2 [illegible]4[illegible]	[illegible]4 [illegible]0[illegible]8	[illegible] [illegible]3[illegible]5	[illegible]7 [illegible]8	39 17	2 94	2[illegible]18

CONTINUES

SONY ENHANCED DATA GRADE D8. DESIGNED TO SAVE YOUR BUSINESS. NOT YOUR BIRTHDAYS.

D-Eight

The more information your business generates, the more you stand to lose. Because not all the 8mm tapes used by business are designed for business.

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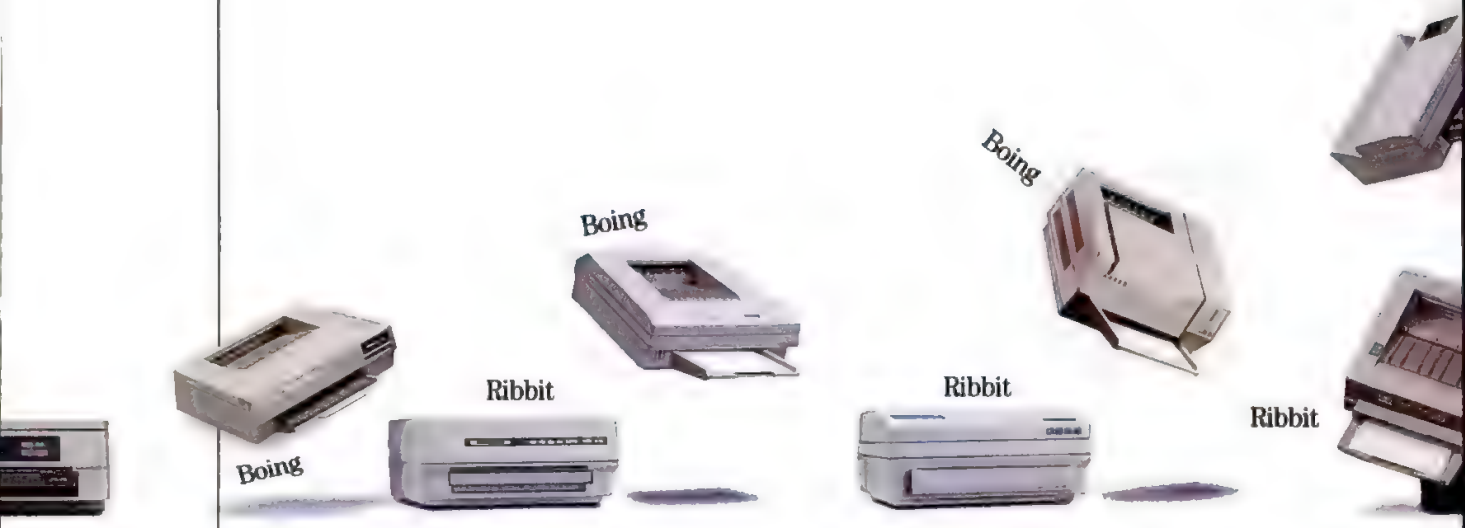
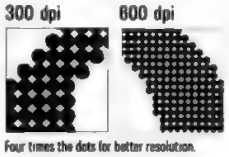
Other laser printers play leapfrog trying to catch up with the HP LaserJet.



The new HP LaserJet 4 printer isn't a hopped-up version of the past generation. Its new, advanced design sets much higher standards for print quality, speed, built-in features and value than ever before.

Higher resolution. More typefaces.

Unlike other 600 dpi laser printers, the HP LaserJet 4 was designed for 600 dpi printing from the ground up. As a result, it produces the best 600 x 600 dpi resolution ever for noticeably crisper, clearer text and graphics. At less than a 300 dpi price.



Four times the dots for better resolution.

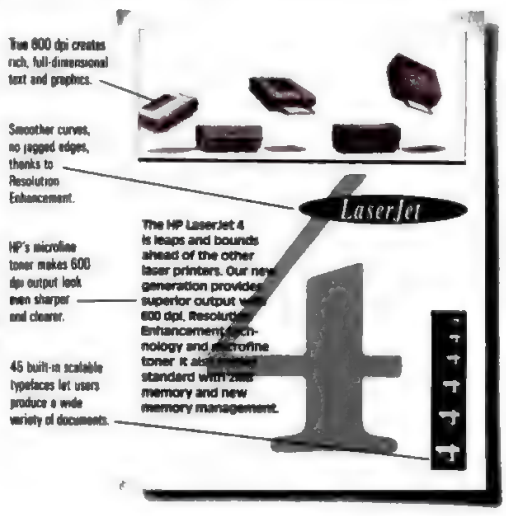
Microfine toner and HP's exclusive Resolution Enhancement technology give you razor-sharp edges and much smoother curves.

With 45 scalable typefaces built into the printer, users can produce a wide variety of documents. Without hassling with downloading or accessory cartridges. Or buying additional typefaces.

More speed, more trays, more flexibility.

Thanks to a new RISC processor, tuned vector graphics and faster I/Os, the HP LaserJet 4 also sets new standards for speed. It even prints many 600 dpi graphics at a true 8 pages per minute. It's faster on networks, too.

With 2 MB of memory built in and new internal memory compression algorithms, virtually all 300 dpi and many 600 dpi documents print from standard memory. Two standard paper trays, with a total capacity of 350 sheets, and an optional 500-sheet tray let users keep printing without constantly reloading different sizes and types of paper. And the optional 75-capacity power envelope feeder saves them from manual feeding. Or dealing with jams.



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Introducing the new HP LaserJet 4 printer. So advanced, there's no catching it.

Mixed environment compatibility. Faster Windows.
The LaserJet 4 is very much at ease with most languages and personal computing platforms. Automatic switching lets it switch between HP's PCL 5 printer language and optional PostScript Level 2 software from Adobe. Hot I/Os allow different hosts to be connected simultaneously.

Optional JetDirect cards provide LAN connections to Ethernet, TokenRing, TCP/IP and LocalTalk/EtherTalk. This makes it easy to plug into just about any network, including PC and Mac LANs. And to get really fast network performance.

To optimize the LaserJet 4 for Windows printing, we codeveloped some breakthroughs with Microsoft.† Including Windows 3.1 TrueType fonts and rasterizer built in to make sure your users get fast, WYSIWYG printing. The fast Windows driver with HP-GL/2 vector graphics also enhances printing speed.

Several popular software drivers are included: Windows, WordPerfect and Lotus. As well as the new HP Explorer PC utility software, which provides a printing tutorial to guide your users through set-up and operation of the printer's new features.

All this makes the HP LaserJet 4 printer supremely simple to plug-and-play. As you'd expect, it also offers complete document and software compatibility with the HP LaserJet III printer.

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With all these advances and more, you'd expect a big jump in price. Quite the opposite. At just $2,199,* the HP LaserJet 4 printer lists for less than the printer it replaces. And, of course, it comes with pace-setting HP quality and reliability.

Call **1-800-LASERJET** (1-800-527-3753), **Ext. 7133** for the name of your nearest authorized HP LaserJet dealer.† And ask for a print sample to see just how great the output looks.**

If it isn't a LaserJet, it's only a laser printer.

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*Suggested U.S. list price. †In Canada call 1-800-387-3867, Ext. 7133. **To have a LaserJet 4 printer data sheet sent immediately to your fax machine, call 1-800-333-1917 from your touch-tone phone. Microsoft is a U.S. registered trademark of Microsoft Corp. Windows 3.1 is a product of Microsoft Corp. Adobe and PostScript are trademarks of Adobe Systems Incorporated, which may be registered in certain jurisdictions. Lotus is a U.S. registered trademark of Lotus Development Corporation.

Benchmark Tests: Upgradable PCs

Higher scores represent better performance	**Processor** (operations per second)	**Memory** (kilobytes per second)	**Video** (thousands of operations per second)	**Disk** (kilobytes per second)	**DOSmark**	**Graphics Winmark** (megapixels per second)	**Disk Winmark** (kilobytes per second)
Micro Express MicroFLEX (Intel 486DX/33)	9,152	5,337	1,450	97.78	50.32	4.90	53.80
Micro Express MicroFLEX (Intel 486DX2/50)	12,539	6,728	1,326	118 96	64.07	5 53	65.98
Micro Express MicroFLEX (Intel 486DX2/66)	16,549	8,849	1,424	139 31	80.44	6.18	81.77
Mitsuba Professional Upgradable (Intel 486SX/25)	4,541	2,826	1,752	107 01	31.46	4 86	41 52
Mitsuba Professional Upgradable (Intel 486DX/33)	5,469	3,298	1,807	120 63	36.97	5.85	47.88
Mitsuba Professional Upgradable (Intel 486DX2/50)	11,428	3,629	1,815	131 79	52.21	7 65	70 84
Mitsuba Professional Upgradable (Intel 486DX/50)	6,691	4,097	1,861	123 82	43.72	7 27	53 50
Mitsuba Professional Upgradable (Intel 486DX2/66)	14 986	4,334	1,870	156 15	63.84	8 94	85.01
Natl Micro Systems Flash 486 Series (Intel 486SX/25)	6,863	3,332	9,108	66 70	35.43	2 27	37 65
Natl Micro Systems Flash 486 Series (Intel 486DX/25)	6,987	3,342	9,123	68 00	35.92	2.27	37.86
Natl Micro Systems Flash 486 Series (Intel 486DX/33)	9,175	3 710	10,188	71 89	41.50	2.97	40 89
Natl Micro Systems Flash 486 Series (Intel 486DX2/50)	12,264	4,053	9,148	75.12	47.26	4.15	43.60
NCC Impact V (Intel 386DX/33)	5,150	3,827	2,790	26.19	22.18	1.54	27.73
NCC Impact V (AMD 386DX/40)	6,229	4,603	3,362	27 02	24.57	1 71	29 60
NCC Impact V (Intel 486SX/20)	5,540	3,231	3 063	27 12	22.38	1 52	27 38
NCC Impact V (Intel 486SX/25)	6,907	4,045	3,325	27 54	24.98	1 92	30 61
NCC Impact V (Intel 486DX/33)	8 884	4,836	3,558	28 34	27.80	2 18	33 31
NCC Impact V (Intel 486DX2/50)	11,086	4,952	3,285	28 65	29.37	2 32	34.21
NCC Impact V (Intel 486DX/50)	13,256	6,681	2,176	28 12	31.23	2 37	34 78
NCR System 3330 (Intel 486SX/25)	6,679	4,066	3,024	26 31	24.15	2 10	29 91
NCR System 3330 (Intel 486DX/33)	8,529	4,895	3,013	27 20	26.90	2 40	34 70
NCR System 3330 (Intel 486DX2/50)	11,263	5,111	3,024	28 28	29.36	2 74	36.76
NCR System 3330 (Intel 486DX2/66)	12,906	5,648	3,015	27.81	30.20	2.90	37.85
NEC PowerMate Image Series (Intel 486SX/25)	6,765	2,824	6,436	29.98	24.17	2.51	30.82
NEC PowerMate Image Series (Intel 486DX/33)	9,186	3,754	7,866	31 91	28.89	3 34	33 66
NEC PowerMate Image Series (Intel 486DX2/50)	11,843	3,103	6,551	30 83	28.20	3 93	35 66
Northgate Elegance ZXP (Intel 486SX/20)	5,521	2,866	1,229	30 28	22.82	3.22	31 98
Northgate Elegance ZXP (Intel 486SX/25)	6,893	3,598	1,248	32 28	26.34	3 74	35 17
Northgate Elegance ZXP (Intel 486DX/25)	7 000	3 585	1,247	32 65	26.58	3 75	34 88
Northgate Elegance ZXP (Intel 486DX/33)	9,338	4,776	1,280	34 51	31.17	4 45	38 43
Northgate Elegance ZXP (Intel 486DX2/50)	12 836	3,996	1,248	30 22	29.59	4 92	40 63
Sirius SST Local Bus Upgradable Series (AMD 386DXL/25)	4,478	2,975	1,778	31 19	21.92	3 37	26 49
Sirius SST Local Bus Upgradable Series (AMD 386DX/40)	5,247	3,303	1,808	32 73	24.14	4 86	32 50
Sirius SST Local Bus Upgradable Series (Intel 486SX/25)	5,964	4,266	1,921	34 93	27.30	4 44	36.73
Sirius SST Local Bus Upgradable Series (Intel 486DX/33)	9,051	3,404	1,845	35 87	29.50	5 21	40.29
Sirius SST Local Bus Upgradable Series (Intel 486DX2/50)	12,135	3,952	1,823	36.85	33.00	6.26	42.26
Spear 486 ISA Convertible (Intel 486SX/25)	6 718	3,509	3,264	36 18	27.77	1 10	25 88
Spear 486 ISA Convertible (Intel 486DX/25)	6,804	3,514	3,266	35 93	27.76	1.10	27.60
Spear 486 ISA Convertible (Intel 486DX/33)	9,112	4,708	4,261	37 59	32.79	1 50	30 87
Spear 486 ISA Convertible (Intel 486DX2/50)	11,661	4,235	3,265	37 09	33.58	1 94	32 67
Spear 486 ISA Convertible (Intel 486DX/50)	13,726	6,961	3,911	34 19	36.23	2.28	36 85
Standard Advantage EISA (Intel 486SX/25)	4,141	3,971	2,705	27 00	21.09	4.55	31.04
Standard Advantage EISA (Intel 486DX/33)	8,435	5,198	2,888	32 23	29.97	5 51	35 78
Standard Advantage EISA (Intel 486DX2/50)	9,354	6,527	2,714	32.84	32.17	6.49	34 62
Standard Advantage EISA (Intel 486DX/50)	10,939	7 509	2 507	33 08	34.12	6 28	33 67
Standard Advantage EISA (Intel 486DX2/66)	12,512	8,658	2,890	29.22	32.85	7.45	38 92
Swan Direct Bus Line (Intel 486SX/25)	6,720	2,871	2,039	28 07	23.29	4 57	29 94
Swan Direct Bus Line (Intel 486DX/33)	8,949	3,859	2,176	29 73	27.39	5 80	33 46
Swan Direct Bus Line (Intel 486DX2/50)	11,769	3,372	2,059	27 92	26.96	6 99	34 69
Swan Direct Bus Line (Intel 486DX2/66)	15,728	4,584	2,443	29 47	31.14	8 45	37 78
Tri-CAD 486 EISA (Intel 486SX/25)	6,822	4,228	1,817	56 68	35.20	5.91	41.34
Tri-CAD 486 EISA (Intel 486DX2/50)	12,456	7,019	1,821	73 90	54.02	6 95	47.70
Wyse Decision 486si (Intel 486SX/20)	5,397	2,472	7,879	27.05	20.97	1.78	26.72
Wyse Decision 486si (Intel 486SX/25)	6,763	3,137	9,097	28 45	24.13	2.22	29.31
Wyse Decision 486si (Intel 486DX/25)	6,853	3,100	9,176	27 65	23.78	2.22	29.66
Wyse Decision 486si (Intel 486DX/33)	8,949	4,068	10,194	29 57	27 79	2 92	31 55
Wyse Decision 486si (Intel 486DX2/50)	11 816	3,712	9,214	29 39	28.64	4 11	32 94
Wyse Decision 486si (Intel 486DX2/66)	15,375	4 818	10,247	29 91	31.86	5 40	34 87
ZDS Z-Station 420SEh (Intel 486DX/33)	7,961	5,518	3,992	33 67	30.63	1 22	39 66
ZDS Z-Station 420SEh (Intel 486DX2/50)	9,586	6,109	3,756	36 91	34.43	1 28	41 15
ZDS Z-Station 420Sn (Intel 486SX/20)	5,066	3,510	3,617	33 01	24.37	0.86	31 04
ZDS Z-Station 420Sn (Intel 486DX/33)	7,897	5,534	4,294	35 03	31.28	1.27	36.52

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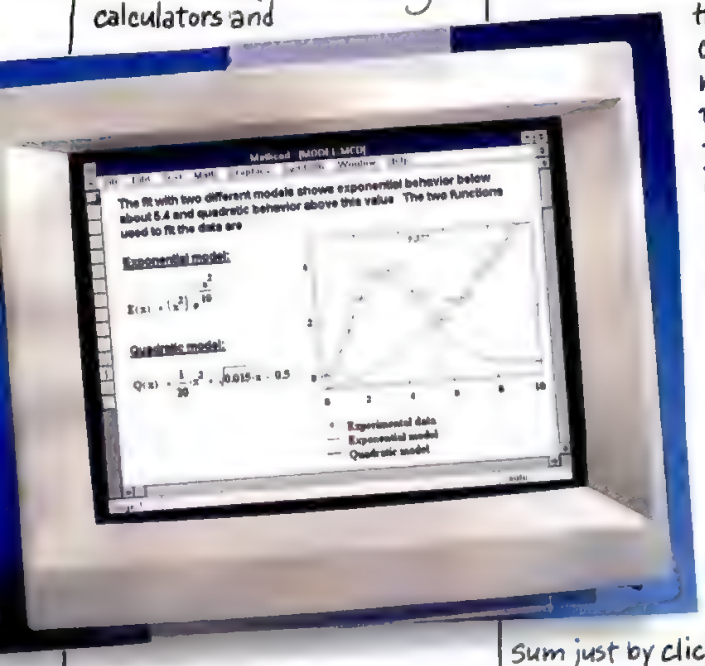

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PCM92

CIRCLE 154 ON READER SERVICE CARD

Upgrading the Omnicache is fairly uncomplicated as long as you don't mind switching the clock crystal and setting the system jumper switches. Unfortunately for the beginner, the Omnicache's documentation was even skimpier than that of the Omniflex, though once you find everything, the process becomes fairly easy.

We tested the Omnicache with a 486SX/25, 486DX/25, 486DX/33, 486DX2/50, 486DX/50, and 486DX2/66 chip. It managed average processor performance with all except the 486DX/25, where it came in last. The ATI Graphics Ultra delivered its usual so-so DOS video and excellent Windows performance, while the Seagate SCSI-2 hard disk managed less than average performance. Lightning's two-year parts-and-labor warranty can be accompanied by on-site service from Integrated Automation International for $100 for the first year.—*OR*

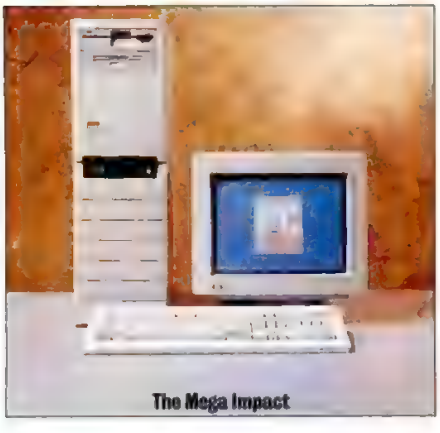
Mega Computer Systems

Mega Impact

The Mega Impact, priced at $2,699 for a 486SX/25 system, was basically an average machine with an easy upgrade at an above-average price.

The tower case embraces four external 5.25-inch drive bays (two holding floppy disk drives), along with one internal 5.25-inch and three internal 3.5-inch bays (one occupied by the Maxtor hard disk). All drive bays are fairly accessible; power, reset, and turbo switches are all front-mounted. A nice feature is the Impact's LED speed display, which indicates either 25 MHz or 50 MHz.

Mega's motherboard uses an Intel chip set and an AMI system BIOS. A BCM-controlled 256K cache supports 8MB of 60-nanosecond RAM (this can vary from 1MB to 64MB on-board). The Maxtor SCSI-2 211MB hard disk with an internal 32K buffer is wired to a Data Technology EISA controller with a 4MB RAM cache. Its video is disappointing: only a 16-bit Prolink adapter running with the S3 chip and 1MB of video memory. In addition to the ISA slot that holds the Prolink, the system comes with six EISA slots and one proprietary slot for the processor plug-in card. The monitor is an unremarkable 14-inch Aamazing CM8428M.



The Mega Impact

FACT FILE

Mega Impact

Mega Computer Systems (a division of Mega Computer Corp.), 10840 Thornmint Rd., San Diego, CA 92127; 800-662-7775, 619-487-8888; fax, 619-485-1518

List price (tested configuration): 486SX/25, $2,699; 486DX/33 upgrade, $280; 486DX2/50 upgrade, $415; 486DX/50 upgrade, $530; 486DX2/66 upgrade, $585

Memory and processor RAM cache: 8MB 60-ns SIMMs, 256K cache

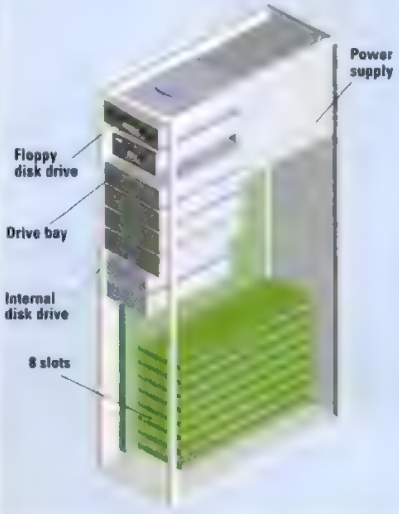
Disk drives and controller: Maxtor LXT-213S SCSI-2 211MB hard disk with internal 32K buffer, Data Technology EISA controller with 4MB RAM cache, 1.2MB and 1.44MB floppy disk drives.

Display: Prolink ISA video adapter with an S3 GUI accelerator and 1MB of VRAM, Aamazing CM8428M monitor, 60-Hz refresh at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1

In short: The EISA-based Mega Impact is an average machine with an easy upgrade.

522 ON READER SERVICE CARD



Upgrading is by means of a plug-in card that holds the processor, oscillator, and external cache. Cards with speedier processors had a fan on top of the processor's heat sink. The procedure is simple, except that you have to remove the drive controller to reach the upgrade card's retaining bracket and update the CMOS settings after each upgrade. System documentation was put together well, with step-by-step instructions for hardware procedures as well as the CMOS task.

We tested the Impact with a 486SX/25, 486DX/33, 486DX2/50, 486DX/50, and 486DX2/66 processor. Though its processor test scores were generally average, this PC's memory test results were always above the average, possibly due to the 60-ns DRAM chips. Video under DOS consistently came in last or very close to it. The SCSI-2 and 4MB cached produced disk test scores that were competitive but not super-speedy.

Mega backs this machine with a one-year parts-and-labor warranty; no on-site service is available.—*OR*

Micro Express

ME 486-Local Bus

At first we thought the ME 486-Local Bus might be the machine to beat in this roundup. A basic configuration price of $1,899 for a 486SX/25 system, and just $851 more to upgrade to a 486DX2/66, gives this system an attractive combination of price, performance, and upgradability. Unfortunately, the company's track record gives us reason to pause. In the past, Micro Express products we have received in the past exhibited erratic behavior and often had to be replaced, but some machines shipped to customers did not contain the same tested components.

The upgrade process is simple and straightforward. A ZIF (zero-insertion-force) socket on the motherboard makes pulling the chip effortless. Then set some well-documented jumper switches and you're ready to go.

The ISA motherboard is from Ergon Technologies. Seven expansion slots are all accessible because of the system's local-bus design, although the innermost slot cannot hold a full-length card. The Weitek socket can be accessed only by removing the vertical floppy disk drive.

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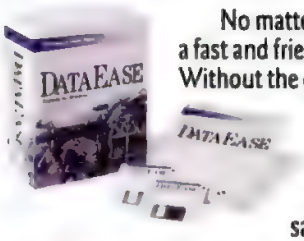

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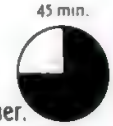

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CIRCLE 075 ON READER SERVICE CARD

IBM

FACT FILE

ME 486-Local Bus

Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; 800-989-9900, 714-852-1400; fax, 714-852-1225

List price (tested configuration): 486SX/25, $1,899; 486/25 upgrade, $200; 486/33 upgrade, $300; 486DX2/50 upgrade, $500; 486DX2/66 upgrade, $851.

Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K cache.

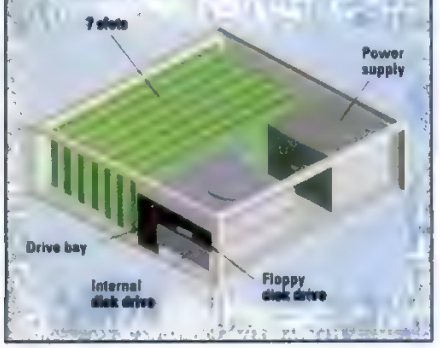
Disk drives and controller: Quantum 240AT 244MB IDE hard disk with 256K cache, 1.2MB and 1.44MB floppy disk drives.

Display: Local-bus video subsystem with Tseng ET4000EP chip set and 1MB VRAM, Micro Express FM-360 14-inch monitor, 70-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The ME 486-Local Bus has an attractive price for its basic configuration, and it was an average performer on most of our benchmark tests; its upgrade path is straightforward.

123 ON READER SERVICE CARD



The system came configured with 8MB of 80-nanosecond RAM backed by a 256K external cache. The hard disk subsystem consisted of a 244MB Quantum ProDrive IDE unit, with the hard disk controller integrated onto the motherboard. The local-bus video subsystem is based on a Tseng chip set and 1MB of VRAM. The 14-inch Micro Express monitor lacks horizontal size and vertical position controls; its top noninterlaced resolution is 1,024-by-768 at a refresh rate of 70 Hz.

We tested this PC with a 486SX/25, 486DX/25, 486DX/33, 486DX2/50, and DX2/66 processor. Its processor performance was average for all the CPUs except the DX2/50, which turned in a below-average memory test score. Its disk scores were also average. Video scores

Micro Express's ME 486-Local Bus

for the DOS-oriented local-bus video were above the average. The manuals clearly document all the features and options, including the upgrade process. The warranty is also a strong point: two years on parts and labor, plus on-site service from GE Computer System at $50 for the first year.—*WPF*

Micro Express

MicroFLEX

For a system priced at $1,699 with a 486SX/25 CPU installed and $2,650 with a 486DX2/66 installed, the MicroFLEX line from Micro Express had the tantalizing prospect of putting price, performance, and easy upgradability together in one package. The system had major flaws, however.

Although it uses a ZIF (zero-insertion-force) socket, it is not the standard lever-assisted type. Instead, you must use a flathead screwdriver to turn a screw a half-twist to release the chip. Next you have to replace the CPU and clock crystal and reset the jumper settings, a process not covered well by the unit's documentation. The MicroFLEX is an ISA desktop PC, but the main manual sent with it was for the company's EISA tower. No hard disk manual was sent, but one is available through an automated fax service.

Micro Express's MicroFLEX

The system came with 8MB of RAM (the system maximum is 32MB) backed by a 256K external cache and 1.2MB and 1.44MB floppy disk drives. The hard disk, a 244MB Quantum ProDrive IDE, is governed by an UltraStor caching disk controller with the maximum 8MB RAM cache. Video is handled by a GUI S3 chip–based Aviewz/2E Super VGA card with 1MB of VRAM. Micro Express ships its own 14-inch monitor, which lacks controls for horizontal and vertical sizing and positioning.

The desktop case is extremely crowded. The cache on the Forex 386/486 Cache motherboard is inaccessible and

FACT FILE

MicroFLEX

Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; 800-989-9900, 714-852-1400; fax, 714-852-1225

List price (tested configuration): 386DX/33, $1,699 Am386/40 upgrade, $20; 486SX/25 upgrade, $100 486/25 upgrade, $200; 486/33 upgrade, $300; 486DX2/50 upgrade, $500; 486DX2/66 upgrade, $851.

Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K cache.

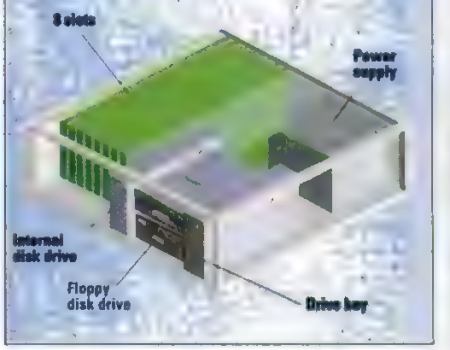
Disk drives and controller: Quantum ProDrive 240AT 244MB IDE hard disk with 256K cache, UltraStor 15F caching disk controller with 8MB RAM, 1.2MB and 1.44MB floppy disk drives.

Display: Aviewz/2E Super VGA adapter with GUI S3 chip set and 1MB VRAM, Micro Express FM360 14-inch monitor, 70-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: This PC has a good price, fair performance and an easy upgrade path, but it is poorly documented

124 ON READER SERVICE CARD



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CIRCLE 228 ON READER SERVICE CARD

the DRAM has limited accessibility. Two of the eight 16-bit slots are obstructed by a metal brace that runs across the center of the machine to support a hard disk bay (the system has four other bays). The obstructed slots can hold only half-length cards.

It took three shipments before we got a system that successfully ran our benchmark tests. When we finally got the system running, however, the performance numbers were favorable. We tested the MicroFLEX with 386DX/33, Am386DX/40, 486SX/25, 486DX/25, 486DX/33, 486DX2/50, and 486DX2/66 CPUs. Processor performance was average. Its disk, Graphics Winmark, and overall DOS scores were above the average, and its video performance on our tests was below the average.

The warranty covers two years on parts and labor; on-site service from GE Computer Service costs $50 for the first year.—*WPF*

Mitsuba Corp.

Mitsuba Professional Upgradable

Though the name Mitsuba Professional Upgradable may imply that you need a professional Mitsuba technician to upgrade this computer, you definitely don't. This $3,349 486SX/25 system, while on the high side of our price range, offers a simple processor plug-in card upgrade, acceptable performance, and even a hardware solution for viruses.

The Mitsuba Professional Upgradable

The Mitsuba's standard desktop case holds two 5.25-inch front-accessible drive bays and one internal 3.5-inch drive bay. Unfortunately, all are occupied out of the factory; a combination 1.2MB/1.44MB floppy disk drive would have been a better solution. The Mitsuba uses an ISA-based PUMA (processor upgradable modular architecture) motherboard, which integrates the processor, the external SRAM cache (256K on our test system), the system's clock, and the AMI BIOS on the processor plug-in card. The rest of the motherboard holds between 1MB and 32MB of RAM (our tested configuration had 8MB), along with a Maxtor 213MB IDE hard disk that has its own 64K buffer and is controlled by a Mitsuba IDE pass-through controller with an 8.5MB cache. The system has one 8-bit expansion slot, four 16-bit slots, and three proprietary local-bus slots. One of these is occupied by a Mitsuba PUMA proprietary local-bus video subsystem with an S3 chip set and 1MB of video DRAM. The 14-inch monitor is fairly unremarkable.

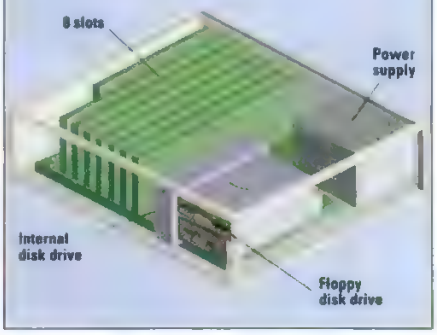
FACT FILE

Mitsuba Professional Upgradable

Mitsuba Corp., 1925 Wright Ave., La Verne, CA 91750; 800-648-7822, 714-392-2000; fax, 714-392-2021

List price (tested configuration): 486SX/25, $3,349; 486DX/33 upgrade, $250; 486DX/50 upgrade, $450; 486DX2/50 upgrade, $500; 486DX2/66 upgrade, $700
Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K external SRAM cache.
Disk drives and controller: Maxtor 7213AT IDE 213MB hard disk with internal 64K buffer, Mitsuba DC-99M IDE pass-through controller with 8.5MB cache, 1.2MB and 1.44MB floppy disk drives
Display: PUMA local-bus video with an S3 chip set and 1MB of video DRAM, Mitsuba M710VX 14-inch monitor, 70-Hz refresh rate at 1,024-by-768
Software: DOS 5.0, Microsoft Windows 3.1
In short: The Mitsuba Professional Upgradable is easy to upgrade, but it was a poor performer on our benchmark tests. With this kind of price tag and list of impressive components, we expected better performance

525 ON READER SERVICE CARD



Upgrading was fairly easy with the plug-in card, but since the BIOS resided on each card individually, we had to reenter all the BIOS information every time. We tested the Mitsuba with a 486SX/25, 486DX/33, 486DX2/50, 486DX/50, and 486DX2/66 processor. Its processor performance across these platforms did not impress us, with scores that were consistently below-average and even last-place with the 486DX/33 and 486DX/50 processors. More noticeable was the Mitsuba's abysmal DOS-based video results—the lowest-scoring player in some instances. Despite its local-bus orientation, the S3 chip just could not adequately handle DOS images. The Mitsuba's memory scores weren't impressive, also placing this PC last on occasion.

Mitsuba provides a one-year parts-and-labor warranty, toll-free technical support during business hours, and on-site service free for the first year.—*OR*

National Micro Systems Inc.

Flash 486 Series

The National Micro Systems' SX-version $2,559 Flash 486 Series performed well on our tests, but the mini-tower's cramped layout makes for a complex upgrading procedure. Reaching system memory is a chore; you may have to remove the drive bay assembly to reach the processor or coprocessor sockets. The case does offer five external 5.25-inch drive bays and one internal 5.25-inch bay.

The Ergon Technologies motherboard integrates up to 32MB of RAM (which is buffered by a 256K external SRAM cache, upgradable to 256K), the

National Micro Systems' Flash 486 Series

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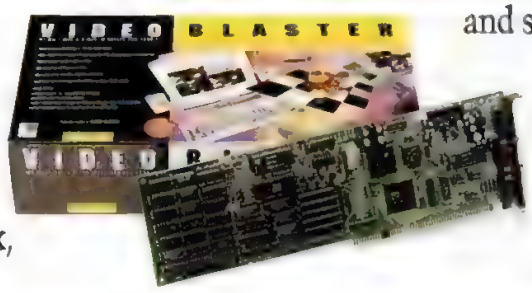
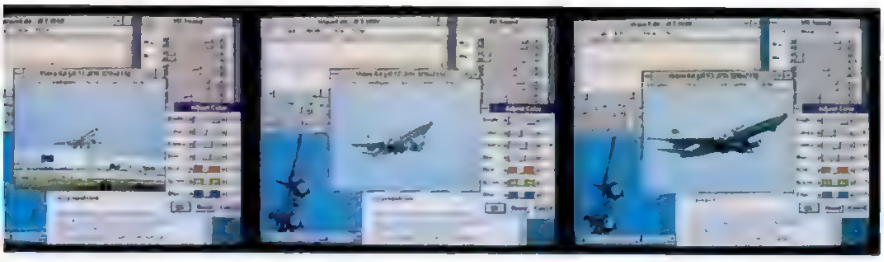


It starts with Video Blaster, an internal video card that lets you display and manipulate full-motion NTSC or PAL video on a standard PC monitor. It also lets you input and mix sound from multiple audio sources.



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CIRCLE 086 ON READER SERVICE CARD

Phoenix BIOS that automatically reconfigures after you upgrade the CPU, and an integrated IDE controller plug, though it is not used. A Seagate 245MB IDE hard disk carries its own 128K cache and is controlled by a 16-bit Promise adapter with another 1MB of cache memory. Video runs through a proprietary local-bus design centered around a Tseng ET4000 chip set with 1MB of video DRAM. I/O ports are run directly off the motherboard as well. The Addonics monitor can multiscan. Documentation is thin and mercilessly technical.

The Flash's test results were impressive, with processor results running above the average for the 486SX/25, 486DX/25, 486DX/33, and 486DX2/50 processors, and nearly the fastest with the higher-level processors. Memory test results ranged slightly below the average; video scores were above par under DOS and were solid in Windows. Disk test scores followed in the same vein: speedy under DOS and acceptably quick under Windows.

The company offers a 15-month parts and two-year labor warranty. On-site service costs $50, and toll-free technical support is available only on weekdays during business hours.—*OR*

FACT FILE

Flash 486 Series

National Micro Systems Inc., 2979-B Pacific Dr., Norcross, GA 30071; 800-642-7649, 404-446-0520; fax, 404-449-5297

List price (tested configuration): 486SX/20 or 486SX/25, $2,559; 486DX/33 upgrade, $239; 486DX2/50 upgrade, $340.

Memory and processor RAM cache: 8MB 60-ns SIMMs, 256K SRAM external cache.

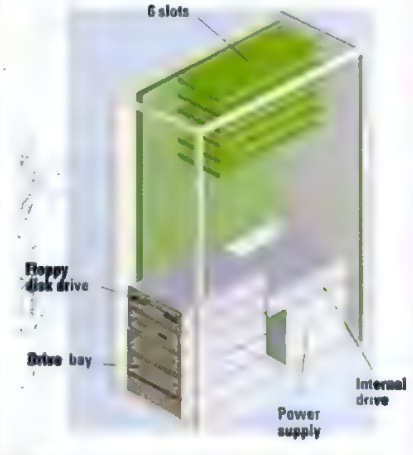
Disk drives and controller: Seagate ST3283A 245MB IDE hard disk with internal 128K buffer, Promise Technology controller with 1MB cache, 1.2MB and 1.44MB floppy disk drives.

Display: Ergon motherboard local-bus video with Tseng ET4000 chip set and 1MB of video DRAM, Addonics monitor, 72-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Flash 486 Series came competitively configured and performed well; its downside is a slightly involved upgrade procedure.

526 ON READER SERVICE CARD



NCC Computer Systems

NCC Impact V

The $2,295 386DX/33 NCC Impact V is a sturdy system, but it suffered from too many hardware, reliability, and upgradability problems to make it recommendable. The tower case is reasonably attractive, with four 5.25-inch bays and one 3.5-inch front-accessible drive bays. Once inside, you will find another two 5.25-inch and one 3.5-inch internal bay. Power, turbo, and reset switches are conveniently front-mounted.

The Vega Cache Series motherboard is upgradable only because it contains a 486 and a 386 processor socket. The 8MB of RAM was buffered by a 256K SRAM external cache (32MB is the on-board maximum). Another 64K of buffer memory is carried internally by the 203MB Maxtor IDE hard disk, which is controlled by a multifunction Identity ISA hard disk controller that also handles the I/O ports. The Diamond SpeedSTAR board handles the video and is connected to a quality 15-inch MAG monitor with digital controls and memory presets.

The NCC Impact V

If you want to upgrade this machine, NCC Computers will send you an instruction packet with your new processor. Though all relevant information is there, it certainly is not user-friendly. Replacing the CPU won't be your only problem, though. You will also have to switch oscillators and set a number of system jumper switches. Though these are fairly accessible, the whole procedure is too involved to rate the Impact V as an easy upgrade.

We tested the Impact V with a 386DX/33, Am386DX/40, 486SX/20, 486SX/25,

FACT FILE

NCC Impact V

NCC Computer Systems, 8212 Blue Ash Rd., Cincinnati, OH 45236; 800-927-1622, 513-793-4141; fax, 513-793-4541

List price (tested configuration): 386DX/33, $2,295; Am386DX/40 upgrade, $50; 486SX/20 upgrade, $100; 486SX/25 upgrade, $110; 486DX/33 upgrade, $429; 486DX/50 upgrade, $549; 486DX2/50 upgrade, $499.

Memory and processor RAM cache: 8MB 60-ns SIMMs, 256K external SRAM cache.

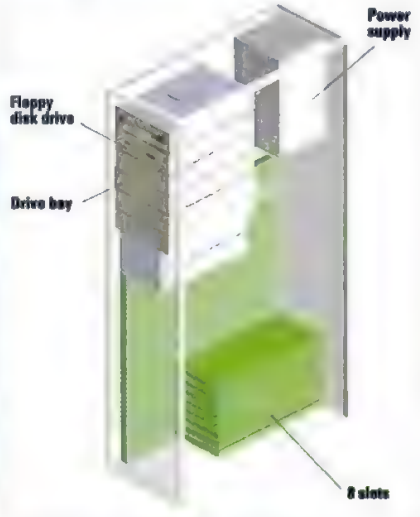
Disk drives and controller: Maxtor 7213AT 203MB IDE hard disk with internal 64K buffer, Identity multifunction controller, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond SpeedSTAR video adapter with 1MB of video memory, MAG MX 15H 15-inch monitor, 60-Hz refresh rate at 1,280-by-1,024.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The NCC Impact V's processor speed is balanced by poor performance in other areas. Because this PC is only marginally easy to upgrade, it is strictly for computer-literate, price-driven buyers.

527 ON READER SERVICE CARD



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486DX/33, 486DX2/50, and 486DX/50 chip. The company had to send three test units before we were able to get one to operate properly. The Impact V's processor test scores were impressive, and on this test the 486SX/20 took the top spot for its class. Memory test scores were generally good, and its disk test scores were also average. Windows video was poor, undoubtedly due to the SpeedSTAR's Tseng ET4000 orientation, but DOS graphics were acceptable.

NCC offers a one-year parts-and-labor warranty, a free year of on-site service, and toll-free technical support.—*OR*

NCR Corp.

NCR System 3330

The NCR System 3330 offers high-quality components and solid construction for $3,100—a price that is near the top of the range for the 486SX/25 class. Its performance was no better than average, and NCR Corp.'s upgrade path, like many seen in this review, was complicated because you first have to remove components before you can reach the CPU.

The NCR System 3330

A small-footprint slimline case offers little space for expansion; there are only three drive bays (two accessible and one internal). One is left empty because NCR Corp. provides only one 1.44MB floppy disk drive. The power switch is up front, but there are no reset or turbo switches.

NCR's ISA-based motherboard is as compact as its case and holds the processor, the external SRAM cache (256K on our test unit), and from 1MB to 32MB of system memory on-board. NCR sent us a Quantum ProDrive 245MB IDE hard disk with a drive controller that, like video, is integrated onto the motherboard. The graphics adapter is based on the 32-bit-wide I/O bus and runs off an NCR chip with 1MB of video DRAM. NCR was one of the few vendors that supplied a system with a 15-inch monitor, whose near-flat screen and wonderful picture quality was a positive aspect.

Upgrading the System 3330's processor requires pulling out the entire drive bay assembly (which is designed to make this as easy as possible) and replacing the CPU in a standard socket. The NCR manuals won't win awards for user-friendliness, but at least they were complete.

Test results were pleasantly on a par with those of other competitors; its memory test results rose above the crowd, but its processor scores dropped below the average across the tested processor classes (486SX/25, 486DX/33, 486DX2/50, and 486DX2/66). Its video managed competitive numbers under both DOS and Microsoft Windows. But NCR should have stuck with the SCSI hard disk present in other NCR systems (see our review of the System 3335 in our October 13, 1992, issue). The hard disk consistently came in well below the average under DOS and slightly so under Windows.

NCR offers a one-year parts-and-labor warranty in addition to a year of on-site service.—*OR*

FACT FILE

NCR System 3330

NCR Corp. (an AT&T Co.), 1700 S. Patterson Blvd., Dayton, OH 45479; 800-225-5627, 513-445-5000.

List price (tested configuration): 486SX/25, $3,100; 486DX/33 upgrade, $400; 486DX2/50 upgrade, $600, 486DX2/66 upgrade, $900

Memory and processor RAM cache: 8MB of 70-ns SIMMs, 256K external SRAM cache.

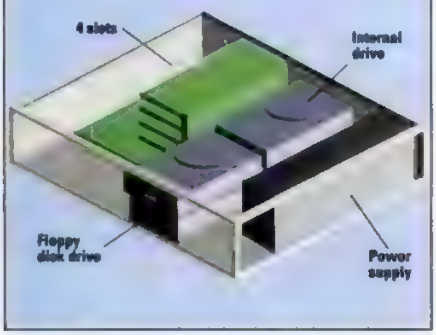
Disk drives and controller: Quantum ProDrive LPS 240AT 245MB IDE hard disk with internal 64K buffer, NCR integrated controller, 1.44MB floppy disk drive.

Display: NCR I/O bus video implementation with 1MB of video DRAM, NCR 0271 15-inch monitor, 70-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The NCR System 3330 is a good system with a great monitor, but it is high-priced.

126 ON READER SERVICE CARD



NEC Technologies Inc.

NEC PowerMate Image Series

The PowerMate Image Series includes high-quality components, performs well, and is backed by one of the leading companies in the field. Its only weakness is its processor upgrade process, which can be daunting if this is the first time you're performing this procedure.

The PowerMate's standard desktop case is constructed of a rigid, thin plastic that doesn't inspire much confidence. It surrounds two external half-height and two internal half-height drive bays; one drive is occupied by a single 1.44MB floppy disk drive, and another contains the Quantum hard disk.

The NEC PowerMate Image Series

NEC's own motherboard uses a flash memory Phoenix BIOS, which can be upgraded easily through software. A modular plug-in daughtercard carries a 64K to 128K secondary SRAM cache (our test unit held 128K). The processor socket is standard and mounted on the motherboard, which can carry between 1MB and 36MB of RAM (our test unit had 8MB), and there are four 16-bit ISA expansion slots mounted vertically. The hard disk and video controllers are on the motherboard.

FACT FILE

NEC PowerMate Image Series

NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-388-8888, 508-264-8000; fax, 508-860-7973

List price (tested configuration): 486SX/25, $2,786, 486DX/33 upgrade, $599, 486DX2/50 upgrade, $799

Memory and processor RAM cache: 8MB of 70-ns SIMMs, 128K external SRAM cache

Disk drives and controller: Quantum ProDrive LPS 240AT IDE 245MB hard disk with internal 256K cache, NEC integrated controller, 1.44MB floppy disk drive.

Display: NEC proprietary local-bus implementation with a Tseng ET4000 chip set and 1MB of video DRAM, NEC Multisync 4FG 15-inch monitor, 70-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The NEC PowerMate Image Series carries an above-average price and is difficult to upgrade, but its system components are of a high quality.

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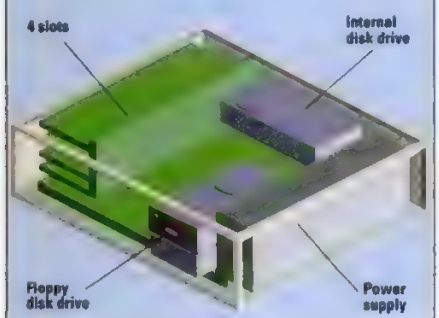

A Quantum ProDrive 245MB IDE hard disk carries its own 256K cache, and video is accomplished through a proprietary local-bus design that is based on a Tseng chip set with 1MB of video DRAM. The monitor is a peerless 15-inch NEC MultiSync monitor.

The Northgate Elegance ZXP

Upgrading the PowerMate is not as easy as it could be. Though the motherboard has multiple clock crystals to choose from, and the processor is fairly accessible, the chip is difficult to remove from its standard socket; a ZIF (zero-insertion-force) socket would have been a welcome relief here. The documentation does a fairly good job of describing this process.

ZD Labs tested the PowerMate with a 486SX/25, 486DX/33, and 486DX2/50 processor. This computer's processor benchmark test results were generally average, but its memory test scores usually dipped below the average despite the 128K SRAM cache. The integral video managed DOS-based video scores that were above the average, but the Windows scores were borderline mediocre. Its scores on our disk benchmark test were average.

NEC backs the PowerMate with a one-year warranty that covers parts and labor; on-site service is free the first year, and the company also offers toll-free technical support.—*OR*

Northgate Computer Systems Inc.

Northgate Elegance ZXP

Though the $2,549 486SX/25 Northgate Elegance ZXP isn't quite the pinnacle of the upgradable PC, it is put together well and offers the performance and attention to detail to rival any direct-marketing competitor.

The Elegance's standard small-footprint case holds three 5.25-inch front-accessible half-height bays and two front-accessible 3.5-inch half-height bays. The power switch is positioned in the rear, and only the reset button graces the case's front.

The custom-designed Mylex motherboard carries six 16-bit expansion slots and one 8-bit slot. The processor is mounted in a ZIF (zero-insertion-force) socket and is accompanied by a versatile synthetic clock crystal as well as a Weitek coprocessor socket. An OPTi chip set controls the 64K external SRAM (it can accomodate up to 256K). System RAM can vary from 1MB to 32MB (our test system came with 8MB) and storage needs are addressed by a Seagate IDE 233MB hard disk with an internal 128K cache and a motherboard-integrated controller. Video is handled by an Orchid Fahrenheit 1280° adapter with an S3 GUI accelerator and 1MB of VRAM. A noticeable weak point in this package is the Panasonic 14-inch monitor, which can only handle 800-by-600 resolution and has its controls configured in a less than ergonomic manner.

Because the Elegance has a ZIF socket, upgrading is actually easier than for many other systems that have the processor mounted on the motherboard. The process is further simplified by a single clock crystal, which can synthesize a range of frequencies. In addition, the documentation is clear and the system jumpers are accessible.

We tested the Elegance with a 486SX/

FACT FILE

Northgate Elegance ZXP

Northgate Computer Systems Inc., 7075 Flying Cloud Dr., Eden Prairie, MN 55344; 800-548-1993, 612-943-8181; fax, 612-943-6965

List price (tested configuration): 486SX/25, $2,549, 486DX/33 upgrade, $300, 486DX2/66 upgrade, $1,000

Memory and processor RAM cache: 8MB 70-ns SIMMs, 64K external SRAM cache.

Disk drives and controller: Seagate ST3283A IDE 233MB hard disk with internal 128K cache, Northgate integrated controller, 1.2MB and 1.44MB floppy disk drives

Display: Orchid Fahrenheit 1280° video adapter with an S3 GUI accelerator and 1MB of video VRAM, Panasonic 138li 14-inch monitor, 60-Hz refresh rate at 800-by-600

Software: DOS 5.0, Microsoft Windows 3.1, QAPlus

In short: The Northgate Elegance ZXP leaves a little to be desired, particularly in terms of its test performance and display. But for the price Northgate Computer Systems is asking, this computer is an acceptable upgradable system

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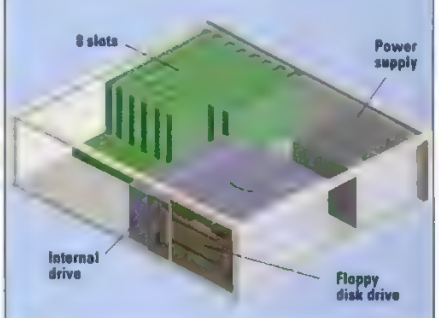

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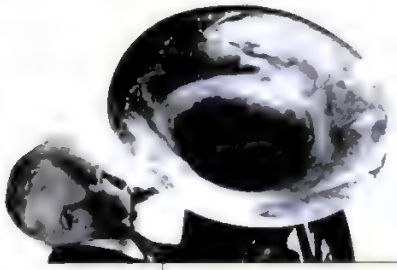

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386DX/33	Intel 80386DX-33 MHz	1 standard 32 max	40	1.2 or 1.44	16 bit SVGA card 14" 640x480 VGA Color Monitor	$849* $32/mo*
386DX/33 or 486SX/25	Intel 80386DX-33 MHz or Intel 80486SX-25 MHz, with built-in 8K CPU cache	2 standard 32 max	80	as above	as above	$999 $37/mo*
486SX/25	Intel 80486SX-25 MHz Built-in 8K CPU cache	as above	80	1.2 & 1.44	16 bit SVGA card 14" 1024x768 SVGA Color Monitor	$1,199 $44/mo*
386DX/33 CACHE	Intel 80386DX-33 MHz 64K CPU cache	4 standard 32 max	120	as above	16 bit SVGA card & Hi-Color Support, 14" 1024x768 SVGA 28 Interlaced Color Monitor	$1,399 $52/mo*
486SX/33	Intel 80486SX-33 MHz 8K CPU cache	as above	120	as above	as above	$1,499 $56/mo*
486DX/33 CACHE	Intel 80486DX-33 MHz 128K CPU cache	as above	120	as above	16 bit SVGA card, 1MB Video RAM & Hi-Color Support, 14" 1024x768 SVGA Non-Interlaced Multisync Color Monitor	$1,799 $67/mo*
486DX/50 CACHE	Intel 80486DX-50 MHz 128K CPU cache True 50 MHz CPU	as above	120	as above	as above	$1,999 $74/mo*
486DX2/66 CACHE	Intel 80486DX2-66 MHz 128K CPU cache New Double Clock CPU	8 standard 32 max	200	as above	16 bit SVGA Superfast Windows Accelerator card, 1MB RAM, 14" 1024x768 SVGA Non-Interlaced Multisync Color Monitor	$2,499 $93/mo*

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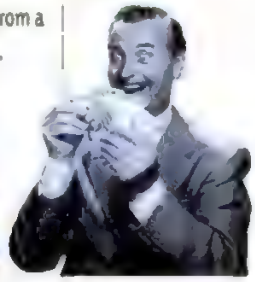

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CIRCLE 132 ON READER SERVICE CARD

20, 486SX/25, 486DX/25, 486DX/33, and 486DX2/50 processor. Processor and memory scores were generally average, while its video came in below the average under DOS graphics and above the average under Windows. Disk scores were average under both DOS and Windows.

Northgate includes a one-year parts-and-labor warranty with free first-year on-site service free from NCR.—*OR*

Sirius Systems Technology Inc.

SST Local Bus Upgradable Series

The SST Local Bus Upgradable Series offers a fairly simple processor plug-in card upgrade and proprietary local-bus technology, all for less than $2,500. Though marred by a few technical complications, this is a solid system.

The SST Local Bus Upgradable Series

A standard small-footprint desktop case holds three front-accessible 5.25-inch half-height and two vertical front-accessible 3.5-inch drive bays. A plastic door covers the reset and turbo buttons, but the power switch is in the rear.

The TMC-manufactured PUMA (processor upgradable modular architecture) motherboard carries a plug-in processor card that also holds the clock crystal, a Weitek socket, and the external SRAM cache. The cache is controlled by a Paradigm chip set and can vary in size from 64K to 256K. On-board RAM varies from 1MB to 32MB (our test unit had 8MB). The PC's storage needs are met by a Western Digital Caviar 212MB IDE hard disk with an internal 64K buffer controlled by an IFSP ISA multifunction controller (it also handles the I/O ports). This is where the company got a little careless. Since the last three of the eight expansion slots are local-bus, and one of the others is an 8-bit slot, that makes the last four 16-bit slots fairly precious. But Sirius Systems Technology wired a single serial port into the rear retaining bracket of one of them, which means more work for you if you need the expansion slot because you will have to do some rewiring. Video is handled off the local bus via an SLB card based around an S3 accelerator and 1MB of video DRAM. A digital 14-inch CTX monitor rounds out this package. You will also find a Super Mouse II, along with PreCursor and other programs.

Upgrading is not as easy as the plug-in processor card might promise, because the Sirius approach requires upgrading the CMOS settings every time. If you want to alter the size of your SRAM cache without buying a whole new processor card, you will have to play with an array of system jumper switches.

We tested the Sirius with AMD Am386DXL/25, 386DX/33, AMD Am386DX/40, 486SX/25, 486DX/33, and 486DX2/50 processors. The processor throughput speeds were generally average, but the Am386DX/40 produced a below-average result. Memory scores were mediocre to competitive. DOS-based video scores were generally poor, while Windows graphics results were competitive but unremarkable; this is surprising since the video adapter was running off the local bus. Disk scores were average.

Sirius accompanies this system with a one-year parts-and-labor warranty as well as free on-site service for the first year.—*OR*

FACT FILE

SST Local Bus Upgradable Series

Sirius Systems Technology Inc., 4344 Young St., Pasadena, TX 77504; 800-424-0724, 713-946-0724; fax, 713-946-5451

List price (tested configuration): Am386DXL/25, $2,150; 386DX/33 upgrade, $25; Am386DX/40 upgrade, $50; 486SX/25 upgrade, $150; 486DX/33 upgrade, $425; 486DX2/50 upgrade, $600.

Memory and processor RAM cache: 8MB of 70-ns. SIMMs, 256K external SRAM cache

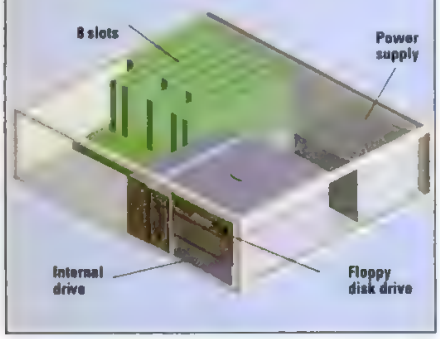
Disk drives and controller: Western Digital Caviar 2200 IDE 212MB hard disk with internal 64K cache, IFSP ISA multifunction controller, 1.2MB and 1.44MB floppy disk drives.

Display: SVLB local-bus video card with S3 accelerator and 1MB of video DRAM, CTX-1460 14-inch monitor, 72-Hz refresh rate at 1,024-by-768

Software: DOS 5.0, Microsoft Windows 3.1, Cache86, PreCursor, Tree86

In short: This upgradable PC is a decent performer with a competitive price.

531 ON READER SERVICE CARD



Spear Technology Inc.

Spear 486 ISA Convertible

Spear Technology's jet-black Spear 486 ISA Convertible tower unit offers a potentially easy upgrade at an affordable price ($2,130 for a 486SX/25). Although it relies on an easy-to-use ZIF (zero-insertion-force) socket for its processor, a lack of documentation may scare the uninitiated away.

To upgrade the Convertible, you need to open the case, remove the CPU from the ZIF socket on the motherboard, put in the new CPU, and reset four jumpers. But because this process is poorly described in the user manual, it may prove nerve-wracking for someone doing it for the first time. Our analyst didn't have a problem, but also had the benefit of upgrading ten other machines in this roundup.

The Spear 486 ISA Convertible

▶ SUMMARY OF FEATURES

Upgradable PCs

List price (*PC Magazine* configuration) For this review of upgradable computers, we requested a configuration that included 8MB of RAM, a 200MB hard disk, a Super VGA color display subsystem capable of 800-by-600 resolution with 256 simultaneous colors (though we accepted 1,024-by-768 as well), one parallel and two serial ports, DOS 5.0, and Microsoft Windows 3.1.

Dealer/direct distribution channel Some machines are sold directly through mail order, others through dealers. Dealers have previously offered discounts of 25 percent or more. *PC Magazine* views a 15 percent discount as typical.

The **number of connectors** on the **power supply** indicates how many internal storage devices the power supply can support without Y cables.

The **processor upgrade path** indicates whether you need a chip puller or module or if there is a ZIF (zero-insertion-force) or LIF (low-insertion-force) socket.

The **BIOS version (or date)** can affect PC Magazine Labs' benchmark test results. A machine with another BIOS may perform differently. **Flash memory** contains BIOS code that can be updated via software. The BIOS is generally stored in conventional ROM, which has no provision for modification.

Installable RAM indicates the amount of memory that can be installed using any combination of chips and proprietary cards.

Cache architecture A *four-way set-associative* cache, native to the 486's internal 8K cache, divides data into four equal blocks and is viewed as most effective. A *two-way set-associative* cache's data is split into two equal blocks, and the data in a *direct-mapped* cache (the most common and least costly) is not divided.

Cache write design A *write-back* design can cache data read from and written to memory. This method is theoretically superior to that of a *posted write-through* cache, which buffers all writes until the memory system bus is free before completing them; and that of a *write-through* cache, in which only reads from memory are cached.

Accessible drive bays can be reached from the system's front panel and can support removable media (such as tape and CD-ROMs). **Internal drive bays** can be reached only by opening the case. We report the maximum number of accessible and internal drives each system can hold. **Floppy disk drives** indicates whether the vendor equips its base-priced system with a 1.2MB floppy disk drive, a 1.44MB floppy disk drive, or both.

Hard disk options We report the range of hard disk capacities the vendor offers.

Disk controller location A computer with IDE (integrated drive electronics) circuitry has its controller functions integrated into the drive and motherboard but may have a separate controller.

Expansion bus For each type of expansion slot—8-bit, 16-bit, 32-bit EISA, 32-bit MCA, and 32-bit proprietary—we report the number of slots on the motherboard. We also indicate whether the motherboard contains integrated parallel, serial, mouse, or Ethernet ports.

The **display circuitry** can reside on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled there is no way to upgrade it. The **video chip set manufacturer** makes the logic that runs the video adapter.

Other bundled software refers to the programs bundled with the system by the manufacturer, free of charge. This generally includes disk caching software (such as SMARTDRV.SYS), expanded-memory-management software (such as QEMM-386), and any other free applications. (If DOS 5.0 and Microsoft Windows 3.1 are not bundled with the system, we added the prices to arrive at the *PC Magazine* standard configuration.)

The **first-year on-site service charge** may be included in the price of the system, or it may be a set or variable amount.

FCC Class B identification number Systems with a Class B rating from the Federal Communications Commission have sufficiently low radio-frequency emissions to be used in the home. To verify any system's status, you may dial up the Public Access Link, the FCC's own bulletin board service, at 301-725-1072.

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▶ SUMMARY OF FEATURES

Upgradable PCs

Products listed in alphabetical order

■ = YES □ = NO

	AcerPower 386/SX	AcerPower 486/SX	ALR Flyer 32DT	ALR Flyer 32LCT	ALR PowerFlex Flyer	Ariel 486SX/25
List price (*PC Magazine* configuration)	$1,293	$2,339	$3,095	$3,823	$2,535	$2,290
Hard disk capacity	212MB	212MB	211MB	325MB	204MB	213MB
Dealer/direct distribution channel	■■	■■	■■	■■	■■	□■
Case style	Small-footprint	Small-footprint	Slimline	Tower	Slimline	Tower
Bus architecture	ISA	ISA	ISA	ISA	ISA	ISA
Power supply (and number of connectors)	145.5 watts (5)	145 watts (4)	230 watts (8)	300 watts (8)	145 watts (5)	250 watts (5)
Motherboard and CPU						
Motherboard manufacturer	Acer	Acer	ALR	ALR	ALR	Micronics
Chip set manufacturer	Acer	Acer	UMC	UMC	OPTi	Micronics
Processor upgrade path	Chip puller	Chip puller	Module	Module	Module	Module
CPUs available	386SX/25, 486SX/25, 486DX2/50	486SX/20, 486SX/25, 486/33, 486DX2/50	486SX/25, 486/33, 486DX2/50, 486DX2/66	486SX/25, 486/33, 486DX2/50, 486DX2/66	486SX/20, 486SX/25	486SX/25, 486/33, 486DX2/50, 486DX2/66
BIOS version (or date)	Acer 1.2 R3	Acer 1.2 R4	Phoenix 1.01.09	Phoenix 1.01.09M	Phoenix 1.01.05	Phoenix 0.10 G.20-2
Flash memory	□	□	■	■	■	□
Weitek/Cyrix coprocessor socket	□□	■□	□□	□□	□□	□□
Memory and Processor RAM Cache						
Installable RAM	2MB–16MB	2MB–98MB	4MB–36MB	4MB–128MB	1MB–16MB	4MB–64MB
External RAM cache	N/A	64K–256K	N/A	N/A	N/A	64K–256K
Cache architecture	N/A	Direct-mapped	N/A	N/A	N/A	Direct-mapped
Cache write design	N/A	Write-back	N/A	N/A	N/A	Write-through
Disk Drives						
Accessible drive bays (5.25", 3.5")	2, 1	1, 1	1, 1	6, 0	1, 1	4, 0
Internal drive bays (5.25", 3.5")	0, 1	0, 1	0, 1	0, 4	0, 1	0, 2
Floppy disk drives (1.2MB, 1.44MB)	1, 1	1, 1	0, 1	1, 0	0, 1	1, 1
Hard disk options	42MB–245MB	42MB–245MB	80MB–535MB	80MB–535MB	60MB–535MB	80MB–535MB
Disk controller location	Motherboard	Card	Card	Card	Motherboard	Card
Expansion Bus						
8-bit/16-bit slots	0, 4	0, 4	0, 4	0, 10	0, 5	0, 8
32-bit EISA/MCA/proprietary slots	None	None	0, 0, 2	0, 0, 2	None	None
Local-bus slots	None	None	None	None	None	None
Parallel, serial, mouse ports on motherboard	1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 1	1, 2, 1	None
Integrated network adapter option	None	None	None	None	None	None
Video						
Display circuitry location	Motherboard	Motherboard	Card	Motherboard	Motherboard	Card
Video chip set manufacturer	ATI	ATI	WD	WD	WD	S3
Software						
DOS 5.0/Microsoft Windows 3.1	■■	■■	■■	■■	□□	■■
Other bundled software	□	□	□	□	□	□
Miscellaneous						
Warranty	1 year	1 year	1 year	1 year	1 year	1 year
First-year on-site service charge	Included	Included	$9.95	$9.95	$9.95	Included
FCC Class B identification number	GQ81172	GQ81172	E7YFR32BS	E7YFR32LCT	E7YMPC386SX-25	IWS486SX25CTEB

N/A—Not applicable. The product does not have this feature
ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc., AST—AST Research Inc., ATI—ATI Technologies Inc., ETEQ—ETEQ Microsystems Inc., SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc., WD—Western Digital, ZEN—Zen Systems Inc.

Upgradable PCs

	AST Power Premium	Atlas ProNet 486UX Series	ATronics ATI-B2 Series	Axik Ace Cache 486ALL! Series	Blue Star Upgradable	BOSS CEO	Clover 486-I Series	Club Falcon 325
	$2,940	$2,435	$1,760	$2,604	$2,077	$5,746	$2,490	$2,242
	244MB	212MB	213MB	210MB	211MB	240MB	200MB	245MB
	□■	■□	■■	■■	■■	■□	■■	■■
	Small-footprint	Tower	Tower	Tower	Tower	Desktop	Tower	Desktop
	EISA	ISA	ISA	ISA	ISA	EISA	ISA	ISA
	145 watts (4)	230 watts (3)	250 watts (6)	200 watts (3)	250 watts (4)	300 watts (4)	230 watts (5)	200 watts (4)
	AST	Nice USA	ATI	Axik	ZEN	AMI	QuickPath	Club
	Intel	ETEQ	UMC	Contaq, Samsung	UMC	Intel	OPTi	Club, VLSI
	Module	Chip puller	Chip puller	ZIF socket	Chip puller	Module	ZIF socket	Module
	386SX/25, 386/25, 386/33, 486SX/25, 486/33, 486DX2/50, 486DX2/66	486SX/20, 486SX/25, 486/33, 486DX2/50	486SX/20, 486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/20, 486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	386DX/25, 386DX/33, Am386/40, 486SX/20, 486SX/25, 486/25, 486/33, 486/50, 486DX2/50, 486DX2/66	Am386/40, 486SX/20, 486SX/25, 486/33, 486/50	486SX/20, 486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	386/25, 386/33, 486SX/20, 486SX/25, 486/33, 486DX2/50, 486DX2/66
	AST 1.06	AMI (7/7/91)	AMI (7/7/91)	AMI 486 (12/12/91)	AMI (7/7/91)	AMI (7/7/91)	Microid Research	AMI (5/5/91) 1.27
	■	□	□	□	■	□	■	□
	■□	■□	■□	■□	■■	□□	■□	■■
	1MB–80MB	1MB–64MB	1MB–64MB	1MB–32MB	1MB–32MB	1MB–128MB	1MB-32MB	2MB-64MB
	16K–20K	64K–256K	32K–256K	64K–256K	64K–256K	128K	64K-256K	64K-256K
	Four-way set-associative	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped
	Write-through	Posted write-through	Write-back	Write-back	Write-back	Write-back	Write-back	Write-back
	2, 1	3, 3	6, 0	3, 2	4, 0	4, 1	3, 2	3, 0
	0, 2	0, 2	2, 0	0, 2	2, 2	2, 0	0, 3	0, 1
	0, 1	1, 1	1, 1	1, 1	1, 1	1, 1	1, 1	1, 1
	80MB–500MB	40MB–2GB	120MB–1GB	40MB–2GB	40MB–525MB	106MB–1.7GB	60MB–1.2GB	50MB–1.2GB
	Motherboard	Card	Card	Card	Card	Card	Card	Card
	None	0, 7	1, 7	0, 7	2, 6	None	0, 8	0, 7
	3, 0, 3	0, 0, 1	None	0, 0, 1	0, 0, 1	7, 0, 0	None	0, 0, 1
	None	None	None	None	None	None	None	None
	1, 2, 1	None	None	2, 1, 0	0, 1, 0	1, 2, 0	2, 2, 0	None
	None	None	None	None	None	None	None	None
	Local bus	Card	Card	Card	Card	Card	Motherboard	Card
	WD	S3	S3	ATI	S3	S3	S3	Tseng
	■■	■■	■■	■■	■■	■□	■■	■■
	□	□	□	□	■	□	■	□
	1 year	1 year	1 year	13 months	1 year	2 years	1 year (3 years on motherboard, I/O, video)	1 year
	N/A	$50	$99	Included	$59	Included	Included	Included
	DJKASTP113-255E	None	E8M5IGATI45X	158ACECACHE486D	A1080201	None	JUI88882DXTIMN	IPS-FALCON 3

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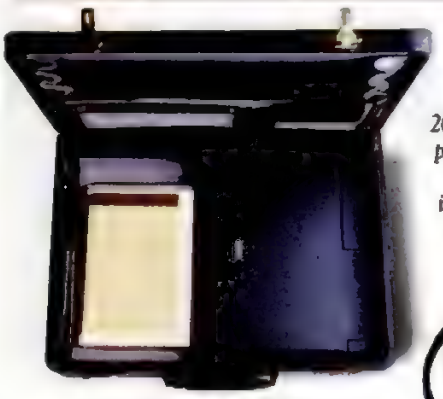

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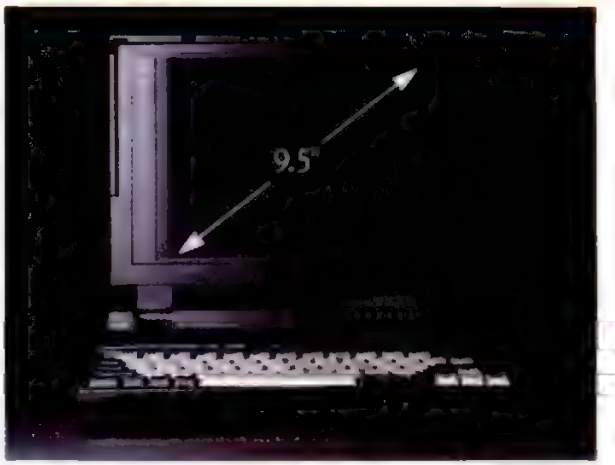

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▶ SUMMARY OF FEATURES

Products listed in alphabetical order

PC EDITORS' CHOICE

■ = YES □ = NO

	Compaq Deskpro I	Compaq Deskpro M	CompuAdd Scalable Systems	Comtrade 486 Local Bus Win-Station	CUBE ATX Upgradable System	Deico Predator
List price (*PC Magazine* configuration)	$2,547	$4,147	$2,295	$2,375	$2,995	$2,170
Hard disk capacity	210MB	340MB	212MB	203MB	212MB	212MB
Dealer/direct distribution channel	■□	■□	□■	■□	■■	■■
Case style	Slimline	Small-footprint	Slimline	Mini-tower	Mini-tower	Desktop
Bus architecture	ISA	EISA	ISA	ISA	ISA	ISA
Power supply (and number of connectors)	145 watts (4)	240 watts (4)	145 watts (5)	250 watts (5)	250 watts (4)	230 watts (3)
Motherboard and CPU						
Motherboard manufacturer	Compaq	Compaq	BCM Advanced Research	Join Data	Deico	Deico
Chip set manufacturer	Intel	Compaq	OPTi	OPTi	Symphony	Symphony
Processor upgrade path	Chip puller	Module	Chip puller	Chip puller	Chip puller	Chip puller
CPUs available	386/25, 386/33, 486SX/25, 486/33	386/25, 386/33, 486SX/16, 486SX/25, 486/33, 486DX2/50, 486DX2/66	386/25, 386/33, Am386/40, 486SX/25, 486/25, 486/33, 486DX2/50, 486DX2/66	486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	Am386DXL/40, 486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	386/25, 386/33, Am386/40, 486SX/20, 486SX/25, 486/25, 486/33, 486/50, 486DX2/50, 486DX2/66
BIOS version (or date)	Compaq (5/15/92)	Compaq (2/25/92)	AMI 2.00	AMI (6/6/91)	AMI 1.1	AMI (12/12/91)
Flash memory	□	□	□	□	□	□
Weitek/Cyrix coprocessor socket	□□	□□	□■	■□	□□	□■
Memory and Processor RAM Cache						
Installable RAM	4MB–32MB	4MB–32MB	4MB–32MB	1MB–128MB	1MB–64MB	1MB–64MB
External RAM cache	16K–64K	64K–256K	128K	64K–256K	64K–256K	64K–256K
Cache architecture	Two-way set-associative	Two-way set-associative	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped
Cache write design	Write-through	Write-back	Write-back	Write-back	Posted write-through	Posted write-through
Disk Drives						
Accessible drive bays (5.25", 3.5")	2, 0	3, 0	1, 1	3, 3	2, 3	3, 2
Internal drive bays (5.25", 3.5")	1, 0	1, 0	0, 1	0, 1	0, 1	None
Floppy disk drives (1.2MB, 1.44MB)	0, 1	1, 0	1, 1	1, 1	1, 1	1, 1
Hard disk options	60MB–510MB	60MB–510MB	80MB–340MB	125MB–1GB	120MB–540MB	80MB–200MB
Disk controller location	Motherboard	Motherboard	Motherboard	Card	Motherboard	Motherboard
Expansion Bus						
8-bit/16-bit slots	0, 3	None	2, 3	0, 7	1, 6	1, 6
32-bit EISA/MCA/proprietary slots	None	6, 0, 1	None	0, 0, 1	None	None
Local-bus slots	None	None	None	None	None	None
Parallel, serial, mouse ports on motherboard	1, 1, 1	1, 2, 1	1, 2, 1	None	1, 2, 1	1, 2, 1
Integrated network adapter option	None	None	None	None	None	None
Video						
Display circuitry location	Motherboard	Card	Local bus	Card	Card	Card
Video chip set manufacturer	Compaq	Compaq	Tseng	S3	S3	Tseng
Software						
DOS 5.0/Microsoft Windows 3.1	■■	■■	■■	■■	■■	■■
Other bundled software	□	□	□	□	□	□
Miscellaneous						
Warranty	1 year	1 year	1 year	2 years	1 year	1 year (2 years on motherboard)
First-year on-site service charge	Included	Included	Included	Included	$50	$75
FCC Class B identification number	CNT75MBFE	CNT75MBD7	JE5450DX2LP-2	JM4486PLBJDCT	IR9ATX01ZCUBE	HA3BA106030

N/A—Not applicable: The product does not have this feature
ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc., AST—AST Research Inc., ATI—ATI Technologies Inc., ETEQ—ETEQ Microsystems Inc., SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc., WD—Western Digital, ZEN—Zen Systems Inc

Upgradable PCs

	Dell 486 D Family	Dell 486 DE Family	DFI Diamond Series Model 333D	Diamond DT486XI	Everex Tempo M Series	IBM PS/2 Model 90	IBM PS/2 Model 95	Int. Instr. Blue Max Monolith
	$2,719	$3,069	$1,863	$2,895	$2,726	$4,225	$5,115	$1,897
	244MB	234MB	118MB	340MB	211MB	160MB	400MB	213MB
	■■	■■	■■	□■	■□	■□	■□	■■
	Small-footprint	Small-footprint	Small-footprint	Tower	Small-footprint	Desktop	Tower	Mini-tower
	ISA	EISA	ISA	EISA	ISA	MCA	MCA	ISA
	224 watts (5)	224 watts (5)	200 watts (5)	230 watts (5)	200 watts (4)	200 watts (3)	329 watts (4)	250 watts (5)
	Dell	Dell	DFI	S&A Labs	Everex	IBM	IBM	Mylex
	VLSI	VLSI	UMC	OPTi	Everex	IBM	IBM	OPTi
	Chip puller	Module	Module	ZIF socket	Module	Module	Module	ZIF socket
	486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	386/25, 386/33, Am386/40, 486SX/20, 486SX/25, 486/33, 486/50	486SX/25, 486/25, 486/33, 486/50, 486DX2/50	386/33, 486SX/20, 486SX/25, 486/33, 486DX2/50, 486DX2/66	486SX/25, 486/33, 486/50, 486DX2/50	486SX/25, 486/33, 486DX2/50	486SX/20, 486SX/25, 486/25, 486/33, 486DX2/50, 486DX2/66
	Dell A07	Dell A08	AMI (3/15/91)	AMI (7/7/91)	AMI 8035	IBM PN 41G9361	IBM 84F9154	Mylex 6.13
	■	■	□	□	□	□	□	□
	□□	■□	■■	■□	■□	□□	□□	□□
	4MB–64MB	4MB—96MB	1MB–64MB	4MB–128MB	1MB–32MB	4MB–64MB	4MB–64MB	1MB–64MB
	N/A	N/A	32–256K	64K–512K	128K–256K	8K–256K	8K–512K	64K–256K
	N/A	N/A	Direct-mapped	Two-way set-associative	Direct-mapped	Two-way set-associative	Two-way set-associative	Direct-mapped
	N/A	N/A	Write-back	Write-back	Write-back	Posted write-through	Posted write-through	Write-through
	3, 0	3, 0	2, 1	3, 2	3, 0	1, 2	5, 0	2, 3
	0, 1	0, 2	1, 0	0, 2	3, 0	0, 1	2, 0	0, 1
	1, 1	1, 1	1, 1	1, 1	1, 0	0, 1	1, 1	1, 1
	80MB–1.4GB	80MB–1.4GB	120MB–210MB	40MB–2GB	43MB–1GB	80MB–1GB	80MB–1GB	40MB–2GB
	Motherboard	Motherboard	Card	Card	Motherboard	Card	Card	Card
	0, 6	None	2, 4	None	1, 6	None	None	1, 6
	None	6, 0, 1	0, 0, 1	8, 0, 0	0, 0, 1	0, 4, 1	0, 8, 1	None
	None	None	None	None	None	None	None	None
	2, 2, 1	2, 2, 1	None	None	1, 2, 0	1, 2, 1	1, 1, 1	1, 2, 0
	None	None	None	None	None	None	None	None
	Motherboard	Motherboard	Local bus	Card	Motherboard	Card	Card	Card
	WD	Tseng	Tseng	WD	Tseng	IBM	IBM	S3
	■■	■■	■■	■■	■■	■□	■□	■■
	□	□	■	□	□	■	■	□
	1 year	1 year	1 year	15 months on parts, 2 years on labor	1 year	3 years	3 years	1 year
	Included	Included	Included	$75	Included	Included	Included	Included
	E2K486D	E2K425DE	E5YPUMA-D	JHT888486B	E3EEX-4200D-AL	None	AN08595A33	E8KSIHBLUEMAX

CONTINUES

Upgradable PCs

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	KEY486SX-25	Lightning Omnicache 486E	Lightning Omniflex 486	Mega Impact	Micro Express ME 486-Local Bus	Micro Express MicroFLEX
List price (*PC Magazine* configuration)	$2,095	$2,125	$1,695	$2,699	$1,899	$1,699
Hard disk capacity	212MB	248MB	245MB	211MB	244MB	244MB
Dealer/direct distribution channel	■■	■■	■■	■■	■■	■■
Case style	Mini-tower	Desktop	Slimline	Tower	Small-footprint	Small-footprint
Bus architecture	ISA	EISA	ISA	EISA	ISA	ISA
Power supply (and number of connectors)	200 watts (5)	230 watts (5)	175 watts (3)	250 watts (4)	200 watts (4)	200 watts (4)
Motherboard and CPU						
Motherboard manufacturer	Chicony	Tyan	AMI	BCM Advanced Research	Ergon	Forex
Chip set manufacturer	SIS	OPTi	AMI, C&T	Intel	C&T/OPTi	SIS/Forex
Processor upgrade path	Chip puller	ZIF socket	ZIF socket	Module	ZIF socket	ZIF socket
CPUs available	486SX/20, 486SX/25, 486/25, 486/33, 486DX2/50	486SX/25, 486/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/25, 486/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/25, 486/25, 486/33, 486DX2/50, 486DX2/66	386/33, Am386/40, 486SX/25, 486/25, 486/33, 486DX2/50, 486DX2/66
BIOS version (or date)	AMI (5/5/91)	AMI OPEISA-F (7/7/91)	AMI 1.2	AMI (5/5/91)	Phoenix/Ergon 1.01	AMI (12/12/91)
Flash memory	□	□	□	□	□	□
Weitek/Cyrix coprocessor socket	■□	■□	□□	□□	■□	■■
Memory and Processor RAM Cache						
Installable RAM	1MB–32MB	1MB–128MB	1MB–32MB	1MB–64MB	1MB–32MB	1MB–32MB
External RAM cache	64K–256K	64K–512K	64K–256K	64K–256K	64K–256K	64K–256K
Cache architecture	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped
Cache write design	Write-back	Write-back	Write-through	Write-through	Write-back	Write-back
Disk Drives						
Accessible drive bays (5.25", 3.5")	3, 1	2, 2	2, 2	4, 0	3, 2	3, 1
Internal drive bays (5.25", 3.5")	1, 1	2, 0	2, 0	2, 2	0, 0	0, 1
Floppy disk drives (1.2MB, 1.44MB)	1, 1	1, 1	1, 1	1, 1	1, 1	1, 1
Hard disk options	85MB–660MB	62MB–2.1GB	120MB–2GB	210MB–1.2GB	170MB–1.2GB	300MB–1.2GB
Disk controller location	Card	Card	Card	Card	Motherboard	Motherboard
Expansion Bus						
8-bit/16-bit slots	0, 7	None	1, 7	0, 1	0, 7	0, 8
32-bit EISA/MCA/proprietary slots	0, 0, 1	8, 0, 0	None	6, 0, 1	None	None
Local-bus slots	None	None	None	None	None	None
Parallel, serial, mouse ports on motherboard	None	None	None	None	None	None
Integrated network adapter option	None	None	None	None	None	None
Video						
Display circuitry location	Card	Card	Card	Card	Local bus	Card
Video chip set manufacturer	S3	ATI	ATI	S3	Tseng	S3
Software						
DOS 5.0/Microsoft Windows 3.1	■■	■■	■■	□□	■■	■■
Other bundled software	■	□	□	□	□	□
Miscellaneous						
Warranty	18 months	2 years	2 years	1 year	2 years	2 years
First-year on-site service charge	Included	$100	$100	N/A	$50	$50
FCC Class B identification number	JTFDATA486s	None	JUT8888ZDXTIMN	None	GUME48650	GXU309ME486

N/A—Not applicable: The product does not have this feature
ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc., AST—AST Research Inc., ATI—ATI Technologies Inc., ETEQ—ETEQ Microsystems Inc., SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc., WD—Western Digital, ZEN—Zen Systems Inc.

Upgradable PCs

	Mitsuba Professional Upgradable	National Micro Systems Flash 486 Series	NCC Impact V	NCR System 3330	NEC PowerMate Image Series	Northgate Elegance ZXP	Sirius SST Local Bus Upgradable Series	Spear 486 ISA Convertible
	$3,349	$2,559	$2,295	$3,100	$2,786	$2,549	$2,150	$2,130
	213MB	245MB	203MB	245MB	245MB	233MB	212MB	245MB
	■□	□■	■■	■■	■□	■■	■■	■■
	Desktop	Mini-tower	Tower	Slimline	Desktop	Small-footprint	Small-footprint	Tower
	ISA	ISA	ISA	ISA	ISA	ISA	ISA	ISA
	200 watts (5)	230 watts (6)	300 watts (3)	250 watts (5)	110 watts (4)	200 watts (5)	200 watts (5)	250 watts (4)
	Mitsuba (PUMA)	Ergon	Vega	NCR	NEC	Mylex	TMC (PUMA)	QuickPath
	OPTi	C&T/OPTi	Symphony	C&T	OPTi	OPTi	OPTi	OPTi
	Module	ZIF socket	Chip puller	Module	Chip puller	ZIF socket	Module	ZIF socket
	486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/20, 486SX/25, 486/25, 486/33, 486DX2/50	386/25, 386/33, Am386/40, 486SX/20, 486SX/25, 486/25, 486/33, 486/50, 486DX2/50	486SX/25, 486/25, 486/33, 486DX2/50, 486DX2/66	486SX/25, 486/33, 486/50, 486DX2/50	486SX/25, 486/33, 486/50, 486DX2/66	Am386DXL/25, 386/33, Am386/40, 486/33, 486SX/25, 486DX2/50, 486DX2/66	486SX/25, 486/25, 486/33, 486/50, 486DX2/50
	AMI 12/12/91	Phoenix 1.01	AMI 1.1	NCR E.02.01	Phoenix A486 1.01	Mylex 6.11	AMI (12/12/91)	Microid Research Mr BIOS 486
	□	□	□	□	■	□	□	□
	■□	□□	□■	□□	□□	■□	■■	■□
	1MB–32MB	1MB–32MB	1MB–32MB	1MB–32MB	1MB–36MB	1MB–32MB	1MB–32MB	1MB–32MB
	1K–256K	64K–256K	64K–256K	64K–256K	64K–128K	64K–256K	64K–256K	64K–256K
	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Four-way set-associative	Direct-mapped	Direct-mapped	Direct-mapped
	Write-back	Write-back	Write-through	Posted write-through	Write-through	Write-through	Write-back	Write-back
	2, 0	5, 0	4, 1	1, 1	0, 2	3, 2	3, 2	4, 0
	0, 1	1, 0	2, 1	0, 1	0, 2	None	None	2, 2
	1, 1	1, 1	1, 1	0, 1	0, 1	1, 1	1, 1	1, 1
	40MB–1.4GB	80MB–1.7GB	40MB-2.2GB	80MB–240MB	60MB–240MB	100MB–1.5GB	40MB–2GB	120MB–2GB
	Card	Card	Card	Motherboard	Motherboard	Motherboard	Card	Card
	1, 4	0, 7	0, 8	0, 4	0, 4	1, 6	1, 4	0, 8
	0, 0, 3	None	None	None	None	None	None	None
	3 proprietary	None	None	None	None	None	3 proprietary	None
	None	1, 2, 1	None	None	1, 1, 1	2, 2, 1	None	None
	□	None	None	None	None	None	None	None
	Local bus	Local bus	Card	Motherboard	Local bus	Card	Card	Card
	S3	Tseng	Tseng	NCR	Tseng	S3	S3	Tseng
	■□	■■	■■	■■	■■	■■	■■	■■
	□	□	□	□	□	■	■	□
	1 year	15 months on parts, 2 years on labor	1 year	1 year	1 year	1 year	1 year	1 year
	Included	$50	Included	Included	Included	Included	Included	Included
	None	None	FI35TAR386CC	CTP3330	B72EL486P	PSNMDI-25-16	FHH3XGPUMA4DT	IBD 48650V

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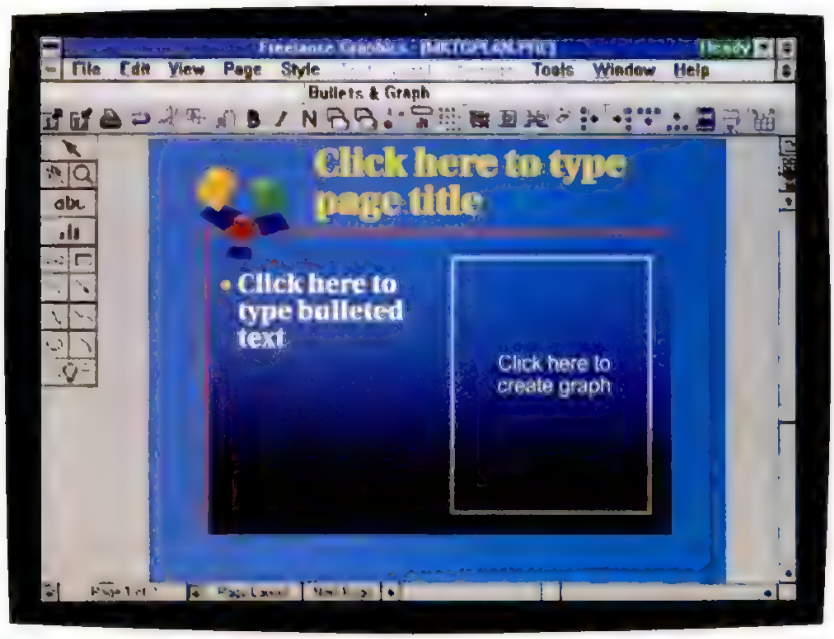

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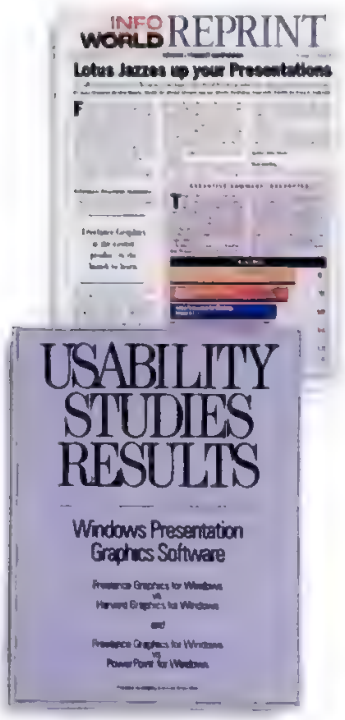

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Upgradable PCs

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	Standard Advantage EISA	Swan Direct Bus Line	Tri-CAD 486 EISA	Wyse Decision 486si	ZDS Z-Station 420SEh	ZDS Z-Station 420Sn
List price (*PC Magazine* configuration)	$2,945	$2,645	$2,695	$2,778	$3,267	$2,517
Hard disk capacity	240MB	213MB	212MB	212MB	212MB	212MB
Dealer/direct distribution channel	□■	■■	□■	□■	■■	■■
Case style	Tower	Desktop	Tower	Slimline	Small-footprint	Slimline
Bus architecture	EISA	ISA	EISA	ISA	EISA	ISA
Power supply (and number of connectors)	145 watts (4)	200 watts (4)	250 watts (6)	200 watts (6)	300 watts (7)	250 watts (5)
Motherboard and CPU						
Motherboard manufacturer	BCM Advanced Research	Swan	Free Technology	Wyse	ZDS	ZDS
Chip set manufacturer	Intel	Syscon	Intel	OPTi	Intel	OPTi
Processor upgrade path	ZIF Socket	Module	Chip puller	ZIF socket	Module	LIF socket
CPUs available	486SX/25, 486/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/20, 486SX/25, 486/25, 486/33, 486/50, 486DX2/50, 486DX2/66	486SX/25, 486/33, 486DX2/50, 486DX2/66	486SX/20, 486/33, 486DX2/50	486SX/20, 486/33
BIOS version (or date)	AMI (5/5/91)	AMI 1.0	AMI (5/5/91)	Phoenix 1 (5/92)	ZDS 1.0	ZDS 1.0
Flash memory	□	□	□	□	■	■
Weitek/Cyrix coprocessor socket	■□	□□	■□	■□	■□	■□
Memory and Processor RAM Cache						
Installable RAM	1MB–64MB	4MB–64MB	4MB–64MB	1MB–64MB	1MB–128MB	4MB–64MB
External RAM cache	64K–256K	128K fixed	64K–256K	N/A	N/A	N/A
Cache architecture	Direct-mapped	Direct-mapped	Direct-mapped	N/A	N/A	N/A
Cache write design	Write-through	Write-back	Posted write-through	N/A	N/A	N/A
Disk Drives						
Accessible drive bays (5.25", 3.5")	6, 0	3, 0	4, 0	2, 3	1, 1	0, 1
Internal drive bays (5.25", 3.5")	None	0, 1	2, 2	None	0, 2	0, 1
Floppy disk drives (1.2MB, 1.44MB)	1, 1	1, 1	1, 1	0, 1	0, 1	0, 1
Hard disk options	40MB–65MB	60MB–400MB	120MB–1.7GB	120MB–210MB	80MB–400MB	80MB–400MB
Disk controller location	Card	Motherboard	Motherboard	Motherboard	Card	Motherboard
Expansion Bus						
8-bit/16-bit slots	0, 1	0, 6	0, 2	1, 5	None	0, 2
32-bit EISA/MCA/proprietary slots	6, 0, 1	0, 0, 1	6, 0, 0	None	4, 0, 0	None
Local-bus slots	None	None	None	None	None	None
Parallel, serial, mouse ports on motherboard	None	2, 2, 1	1, 2, 1	1, 2, 1	1, 1, 1	1, 1, 1
Integrated network adapter option	None	None	None	None	Ethernet	Ethernet
Video						
Display circuitry location	Card	Local bus	Card	Local bus	Motherboard	Motherboard
Video chip set manufacturer	ATI	S3	S3	Tseng	WD	WD
Software						
DOS 5.0/Microsoft Windows 3.1	■■	■■	■■	■■	■■	■■
Other bundled software	■	■	□	□	■	■
Miscellaneous						
Warranty	2 years	2 years	2 years	1 year	1 year	1 year
First-year on-site service charge	Included	Included	Included	$99	Included	Included
FCC Class B identification number	F54STBD486D3VPT	HOYSWAN3486M-13	None	DYD901101	IFO-ZDESKB	IFO-ZDESK420

N/A—Not applicable: The product does not have this feature
ALR—Advanced Logic Research Inc., AMI—American Megatrends Inc., AST—AST Research Inc., ATI—ATI Technologies Inc., ETEQ—ETEQ Microsystems Inc., SIS—Silicon Integrated Systems Corp., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc., WD—Western Digital, ZEN—Zen Systems Inc

ENDS

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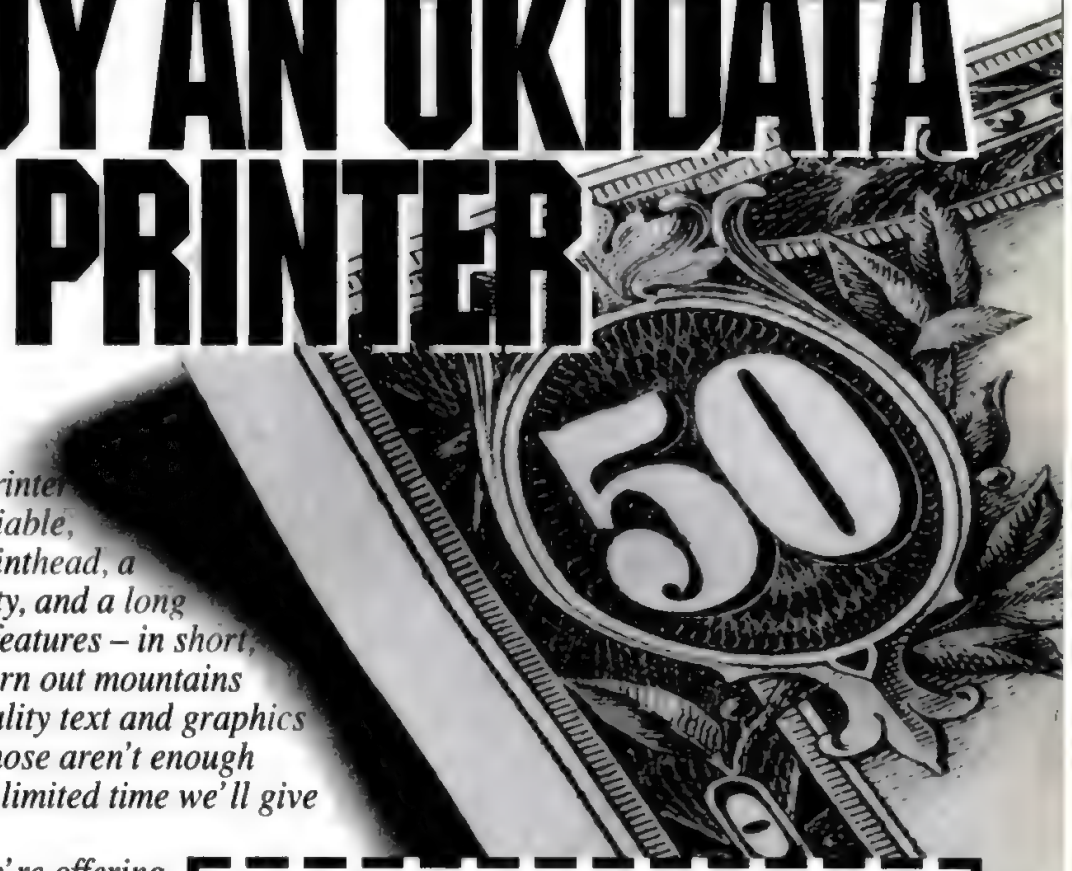

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202

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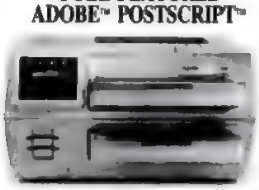
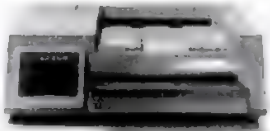


OL830:
ADOBE™ POSTSCRIPT™ FOR TEXT AND GRAPHICS

OL810:
BUSINESS CLASS TEXT AND GRAPHICS



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CIRCLE 056 ON READER SERVICE CARD

FACT FILE

Spear 486 ISA Convertible

Spear Technology Inc., 425 Country Club Dr., Bensenville, IL 60106; 800-852-4202, 708-616-7800; fax, 708-616-7811

List price (tested configuration): 486SX/25, $2,130; 486DX/25 upgrade, $120; 486DX/33 upgrade, $300; 486DX2/50 upgrade, $400; 486DX/50 upgrade, $450.

Memory and processor RAM cache: 8MB of 70-ns SIMMs, 64K cache.

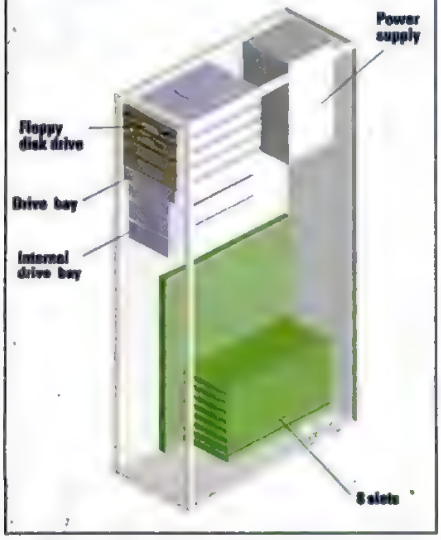
Disk drives and controller: Quantum ProDrive LPS 240AT 245MB IDE hard disk, Kouwell adapter, 1.2MB and 1.44MB floppy disk drives.

Display: Orchid ProDesigner II adapter with 1MB DRAM and Tseng chip set, Ancer CM-1402 14-inch monitor, 43-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Spear 486 ISA Convertible, despite its avant-garde look, is an average performer with a less than straightforward upgrade process.

122 ON READER SERVICE CARD



The Convertible's QuickPath motherboard was the same as the one in the Clover 486-I Series (reviewed in this story) and came equipped with 8MB of RAM and a 64K cache; these options can be expanded to 32MB and 256K, respectively. Two of the unit's eight 16-bit slots were filled with an I/O card and the Orchid ProDesigner II video adapter. A Quantum 245MB hard disk came with the system, as did the 14-inch Ancer monitor.

The ISA convertible performed at or a little above the average at each processor level we tested (486SX/25, 486DX/25, 486DX/33, 486DX2/50, and 486DX/50), which was balanced by slightly below-average performance on our disk test. The system's 70-nanosecond RAM rated average on our memory test, and the Orchid ProDesigner II video adapter with its Tseng chip set finished strong on our DOS-based video test but lagged in terms of our Graphics Winmark test. The DOSmark result was slightly above the average.

But most users would find themselves stranded by the lack of documentation. The manuals were a collection of leaflets pertaining to the individual components. The warranty is a little better: one year on parts and labor with on-site service included for the first year.—*WPF*

Standard Computer Corp.

Standard Advantage EISA

Computer makers want to integrate as many quality components as possible while still keeping the price down. Standard Computer Corp.'s $3,275 486DX2/50 Standard Advantage EISA manages to do this, with competitive performance and a simple upgrade procedure.

The Advantage arrived in a full tower case enclosing six external 5.25-inch drive bays. Reset, turbo, and power switches are all front-mounted.

The BCM motherboard is actually an EISA/ISA mix, with six EISA expansion slots and one ISA slot. The system BIOS is by AMI, and an Intel chip set controls the system's 256K cache. You can put from 1MB to 64MB of RAM on the motherboard. The 240MB Quantum hard disk is hooked to a DTC EISA pass-through controller. An ATI Graphics Ultra card with 1MB of VRAM handles the video and is connected to the outstanding 14-inch MAG monitor. This system also includes DOS 5.0, Microsoft Windows 3.1, Norton Desktop for Windows 2.0, HyperDisk, and your choice of one of eight popular applications.

The Standard Advantage EISA

Upgrading would have been a little easier with the inclusion of a ZIF (zero-insertion-force) socket, but because the roomy tower gives you enough accessibility, using a chip puller was not as annoying as it usually is.

We tested the Advantage with a

FACT FILE

Standard Advantage EISA

Standard Computer Corp., 12803 Schabarum Ave., Irwindale, CA 91706; 800-662-6111; fax, 818-960-2926

List price (tested configuration): 486SX/25, $2,945; 486DX/33 upgrade, $180; 486DX2/50 upgrade, $330; 486DX/50 upgrade, $480; 486DX2/66 upgrade, $680; further upgrades reflect the price of the CPU only and are available at retail outlets.

Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K cache.

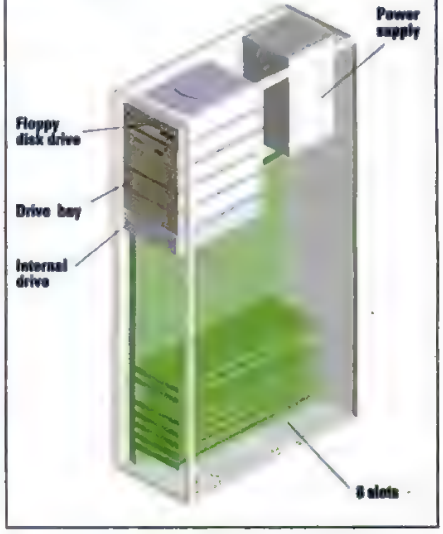
Disk drives and controller: Quantum ProDrive LPS 240AT 240MB IDE hard disk, DTC EISA disk controller, 1.2MB and 1.44MB floppy disk drives.

Display: ATI Graphics Ultra card with Mach 8 GUI accelerator and 1MB of VRAM, MAG LX1460 14-inch monitor, 72-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1, Norton Desktop for Windows 2.0, HyperDisk; choice of Ami Pro, AutoDesk Generic CAD 6.0, Freelance Graphics for Windows, Lotus 1-2-3 for Windows, Paradox, Turbo C++, or Turbo Pascal.

In short: The Standard Advantage EISA barely qualifies as an upgradable system, but it is a good value.

123 ON READER SERVICE CARD



486SX/25, 486DX/33, 486DX2/50, 486DX/50, and 486DX2/66 chip. Its scores were competitive on just about everything except the processor test, where it trailed. Its processor scores were so closely grouped that you probably wouldn't be able to tell the difference when you use it.

Standard offers a two-year parts-and-labor warranty, with free first-year on-site service from TRW.—*OR*

Swan Technologies Inc.

Swan Direct Bus Line

Inside the $2,645 Swan Direct Bus Line, you will find a well-thought-out package capable of solid performance. When you swap the plug-in processor card to upgrade the CPU, you upgrade the clock at the same time. Since the local bus is tied in to the CPU clock, you also get improved video performance. In addition, the system automatically senses the processor type and then optimizes the cache configuration for a variety of processors.

The Swan's standard desktop case has four drive bays: three external 5.25-inch and one internal 3.5-inch. All system controls are front-mounted.

Inside, the Swan motherboard is nicely laid-out, featuring a modular processor upgrade card and local-bus video. The plug-in card carries the processor, an alternate upgrade socket, an external cache (limited to 128K), and the clock crystal. The AMI BIOS automatically senses what processor is mounted in the socket and adjusts the system configuration accordingly.

Upgrading the RAM in the Swan machine requires resetting a few jumper switches (our test unit came equipped with 8MB, and 64MB is the on-board system maximum). The Maxtor 213MB IDE hard disk has its own 64K buffer and is integrated directly onto the motherboard. Swan's own local-bus video implementation is based on S3's latest chip, the 86C924, and has 1MB of VRAM. The Swan 14-inch monitor makes due with analog controls; contrast and brightness are at the front and side, but the horizontal/vertical size and position controls are on the back. Swan bundles not only DOS 5.0, Microsoft Windows 3.1, and a mouse with the package, but also includes Microsoft Works, Quicken for Windows, and Wealth Builder.

We tested the Swan unit with the 486SX/25, 486DX/33, 486DX2/50, and 486DX2/66 processors. Processor test scores were competitive, while memory results were average to slightly below the average. The Swan's disk scores on our tests were average throughout. The Swan's local-bus video suffered under DOS, a characteristic of the S3 chip, but improved under Windows.

The Swan Direct Bus Line

Swan's warranty is as competitive as the rest of this system: two years on parts and labor, along with two years of free on-site service, which is provided by TRW.—*OR*

FACT FILE

Swan Direct Bus Line

Swan Technologies Inc., 3075 Research Dr., State College, PA 16801; 800-468-9044, 814-243-2236; fax, 814-237-4450

List price (tested configuration): 486SX/25, $2,645; 486DX/33 upgrade, $300; 486DX2/50 upgrade, $500; 486DX2/66 upgrade, $800.

Memory and processor RAM cache: 8MB 80-ns SIMMs, 128K cache.

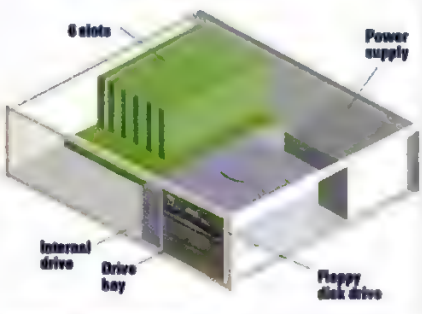
Disk drives and controller: Maxtor 7213AT 213MB IDE hard disk with internal 64K buffer, Swan integrated controller, 1.2MB and 1.44MB floppy disk drives.

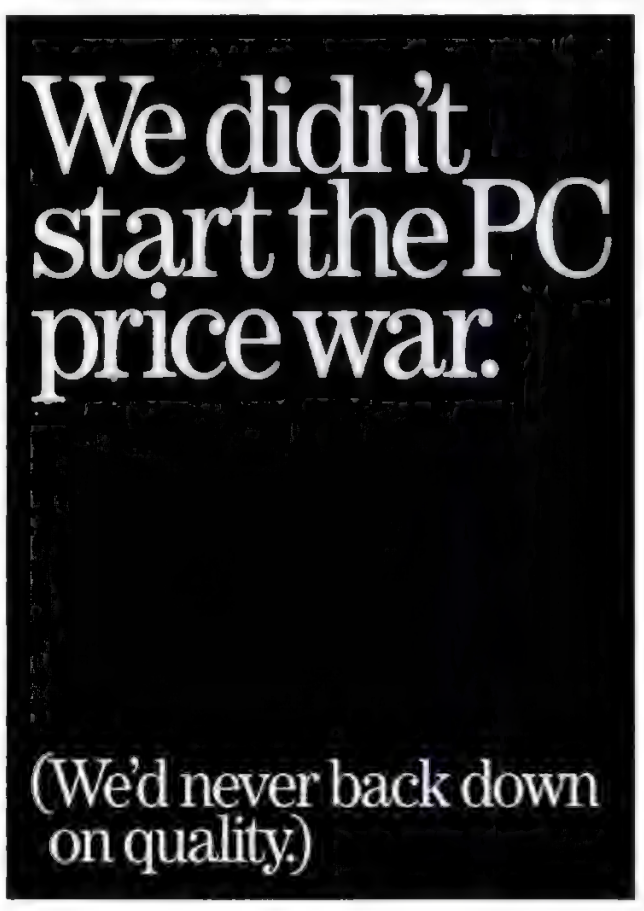
Display: Swan local-bus video with an S3 86C924 chip and 1MB of VRAM, 14-inch Swan 1024 VGA NI monitor, 60-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1, Microsoft Works, Quicken for Windows, Wealth Builder.

In short: A good price, a well-filled-out package, solid performance, and easy upgrades make the Swan Direct Bus Line a serious contender.

534 ON READER SERVICE CARD





Tri-Star Computer Corp.

Tri-CAD 486 EISA

At $2,695 with a 486SX/25 processor, the Tri-CAD 486 EISA is a significant value when you consider the amount and quality of its components and its performance scores on our tests. While its no-frills chip-puller approach to upgrading won't win any awards, the roomy case and a logical layout compensate for this.

The Tri-CAD came in a standard tower case constructed of metal and a flexible plastic. Power, reset, and turbo switches are in front. There are four external 5.25-inch drive bays and four internal ones (two 5.25-inch and two 3.5-inch).

A Free Technology motherboard based on the EISA bus is easy to access. The system BIOS is by AMI. Intel's chip set resides here, as well as a 256K external cache. Although there is no OverDrive socket, a Weitek plug is supported. Two 16-bit ISA and six 32-bit EISA expansion slots are located toward the rear, with one

The Tri-CAD 486 EISA

ISA slot and two EISA slots filled.

A SCSI-2 Maxtor 212MB hard disk has a 64K buffer. Video runs on the ISA bus via a Diamond Stealth VRAM card with an S3 GUI accelerator and 1MB of VRAM. A 14-inch MAG monitor can handle a noninterlaced resolution up to 1,024-by-768 at 72 Hz. Upgrading the Tri-CAD isn't too big a hassle, mainly because all the necessary elements are easily accessible. The upgrade process starts with pulling the old chip out of the motherboard and inserting the new one, followed by replacing the oscillator crystal.

We tested the Tri-CAD with only the 486SX/25 and 486DX2/50 processors, but it scored above the norm across the board. The SCSI-2 disk numbers were excellent as expected in both DOS and Windows environments; memory, disk, and Windows graphics numbers were average or slightly above. Only on our DOS-based video test did the Tri-CAD fare below the average.

With Tri-Star's two-year parts-and-labor warranty and free first-year on-site service from NCR Corp., this system is well worth a closer look by the price-conscious.—*OR*

FACT FILE

Tri-CAD 486 EISA

Tri-Star Computer Corp., 120 S. Weber Dr., Chandler, AZ 85226; 800-678-2799, 602-961-3401; fax, 602-961-4010

List price (tested configuration): 486SX/25, $2,695; 486DX2/50 upgrade, $400.

Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K cache.

Disk drives and controller: Maxtor LXT213SY SCSI-2 212MB hard disk with internal 64K buffer, QUME EISA controller with 2MB cache, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond Stealth VRAM adapter with an S3 chip and 1MB of video VRAM, MAG 14H 14-inch monitor, 72-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Tri-CAD 486 EISA produced excellent scores on our tests and is priced low enough to warrant close attention from most buyers.

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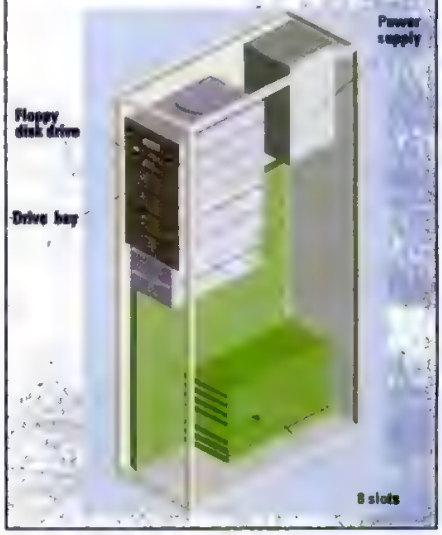


Wyse Technology

Wyse Decision 486si

The Wyse Technology Decision 486si can accomodate processors between a 486SX/20 and 486DX2/66. For $2,778, you get a solid performer with excellent local-bus video, and fairly easy upgradability. The only snag is that you must buy the upgrade parts from another vendor.

The Decision's slimline case holds two external 5.25-inch bays and three external 3.5-inch bays (two are occupied by the lone 1.44MB floppy disk drive and the hard disk). All switches are front-mounted.

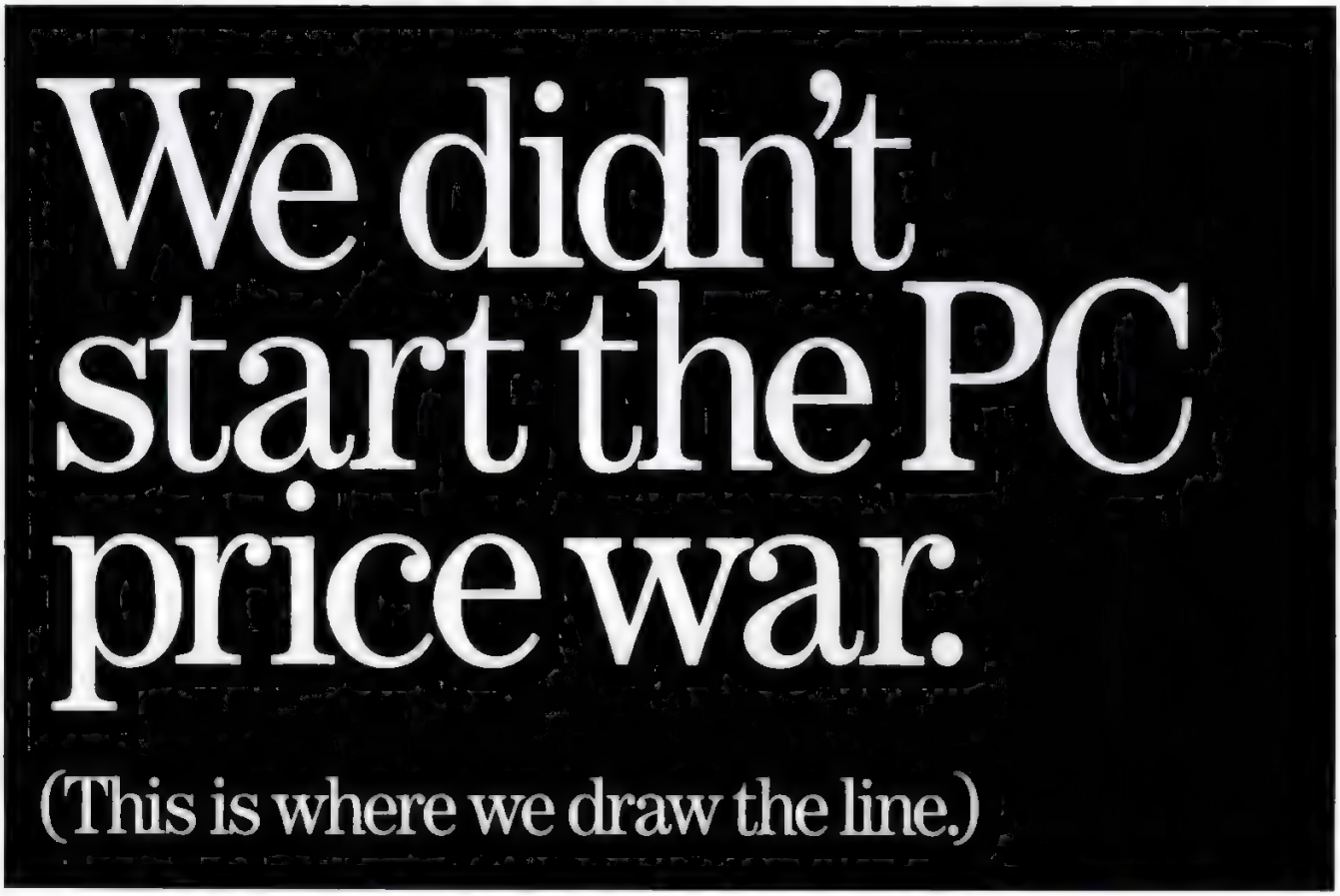
The Wyse Decision 486si

Wyse's 486 motherboard, which is adaptable to both SX and DX varieties of the chip family, uses a Phoenix BIOS and carries all system essentials. Although upgrading the processor is not as easy as with a processor plug-in card, the use of a ZIF (zero-insertion-force) socket, an auto-sensing BIOS, a variable clock crystal, and a minimum of jumper switches keeps your upgrade hassles to a minimum. System RAM can vary from 1MB to 64MB on-board (our test unit had 8MB). The Decision lacks an external cache, which could be a disadvantage with high-level processors like the 486DX2/66.

Upgrading the Tri-CAD 486 EISA is not a hassle, mainly because all the necessary elements are easily accessible.

Wyse uses a Maxtor 212MB IDE hard disk and integrated the controller directly onto the motherboard. The decision to place drive controller circuitry, I/O ports, and local-bus video on the motherboard leaves the system' five 16-bit slots and one 8-bit slot open for future expansion. All are stacked vertically to save space, if not to ease end-user installation. The video subsystem, dubbed the Hyper 16, uses a Tseng chip set with 1MB of video DRAM. Wyse's own 14-inch monitor added little to further the good standing of this unit but managed to satisfy most of its job requirements adequately.

We tested the Decision with a 486SX/20, 486SX/25, 486DX/33, 486DX2/50, and 486DX2/66 CPU. Its processor test scores ranged from competitive to very good, and memory testing showed it as



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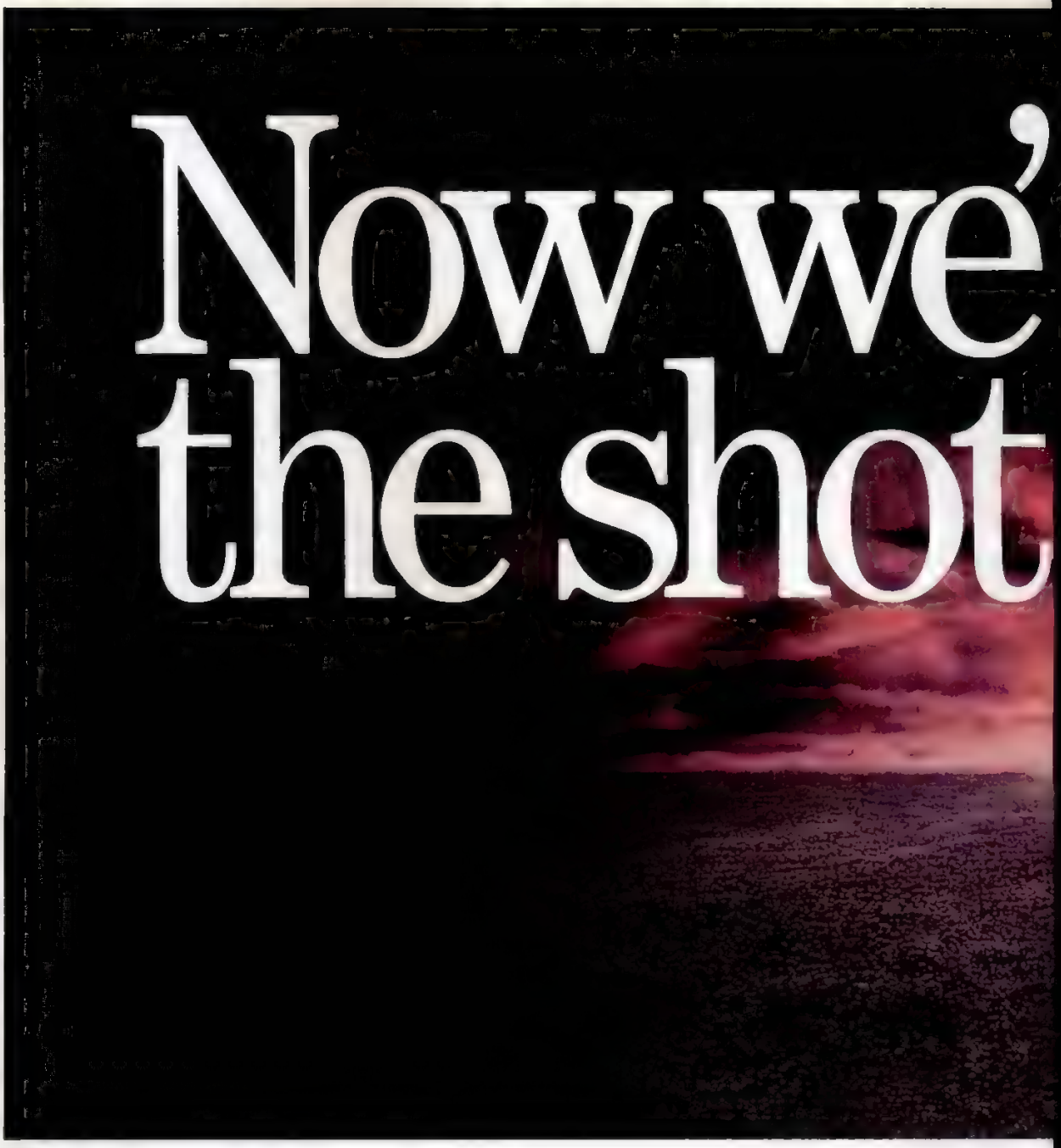

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intel inside

486N Specifications • 32-bit Intel SX, DX and DX2 processors at 25, 33, 50 and 66 MHz. • 4 MB RAM, expandable to 48 MB • Local bus integrated Ultra VGA+ Video with graphics accelerators • 85-430 MB hard drive • 3.5" floppy drive • Three 16-bit expansion slots • ROM-based internal diagnostic and system guide • Integrated Flash BIOS and boot-ROM • Multilevel hardware security • Chip-upgradable

*Suggested U.S. list prices for HP 486/25N and HP 486/33N Model 1 PCs. †Press 1 for HP FirstReference Document [illegible]. ‡Microsoft and MS are registered trademarks of Microsoft Corporation. Windows 3.1 is a product of Microsoft Corporation. The Intel Inside logo is a U.S. trademark of Intel Corporation. ©1992 Hewlett-Packard Company. PPC/656

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HEWLETT PACKARD

FACT FILE

Wyse Decision 486si

Wyse Technology, 3471 N. First St., San Jose, CA 95134; 800-428-9973, 408-473-1200; fax, 408-473-1972

List price (tested configuration): 486SX/20, $2,779; all upgrades are available only through retail vendors.

Memory and processor RAM cache: 8MB 80-ns SIMMs.

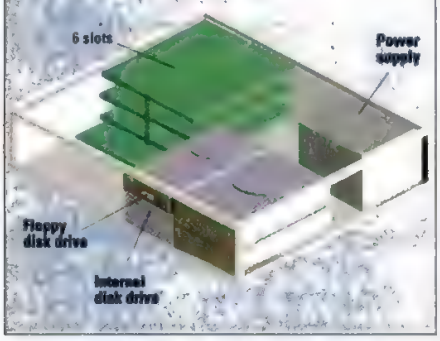
Disk drives and controller: Maxtor LXT213A 212MB IDE hard disk with internal 64K buffer, Wyse integrated controller, 1.44MB floppy disk drive.

Display: Wyse proprietary Hyper 16 local-bus implementation with a Tseng ET4000 chip set and 1MB of video DRAM, Wyse Wy-670 14-inch monitor, 60-Hz refresh rate at 1,024-by-768.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: Wyse Technology successfully combines a competitive price, good performance, and a straightforward upgrade path.

536 ON READER SERVICE CARD



average. The Decision's disk test scores were usually below the average, but the local-bus video managed extremely good scores under DOS, and the top rating in the 486 DX2/50 and 486DX2/66 processor classes. The system had decent, though not remarkable, results under Windows.

Wyse backs this system with a one-year parts-and-labor warranty; on-site service costs $99 for the first year.—*OR*

Zenith Data Systems

ZDS Z-Station 420SEh

The $3,267 486SX/20 ZDS Z-Station 420SEh is the midsized EISA system in Zenith Data Systems' new PC line. Like the Z-Station 420Sn (reviewed below), the sleekly styled 420SEh is based on a new modular upgrade design. It also contains a bonus for those interested in networking: an integrated Ethernet card and the software shells for three popular networking systems (Novell's NetWare, Microsoft LAN Manager, and Banyan's VINES). Unfortunately, the 420SEh also has its sibling's awkward processor upgrade path, easily damaged interior plastic components, and performance lapses.

The 420SEh's attractive case holds two external drive bays (one 5.25-inch and one 3.5-inch) and two internal 3.5-inch bays. There is also a surprisingly powerful 300-watt power supply, controlled by a side-mounted switch.

FACT FILE

ZDS Z-Station 420SEh

Zenith Data Systems, 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089; 800-553-0331, 708-808-5000

List price (tested configuration): 486SX/20, $3,267; 486DX/33 upgrade, $1,229; 486DX2/50 upgrade, $1,618.

Memory and processor RAM cache: 8MB 80-ns SIMMs.

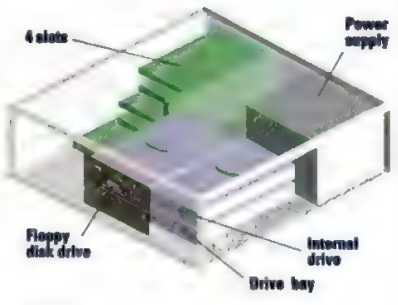
Disk drives and controller: Western Digital Caviar 2200 IDE 212MB hard disk with internal 64K cache, ZDS integrated controller, 1.44MB floppy disk drive.

Display: ZDS integrated video with a WD 90C30 chip set and 512K video DRAM, ZCM-1410 monitor, 60-Hz refresh rate at 640-by-480.

Software: DOS 5.0, Microsoft Windows 3.1, Microsoft LAN Manager 2.1, NetWare 3.11, VINES 4.11.0.

In Short: This attractive entry by Zenith Data Systems comes in a large case, the Z-Station 420Sn, but still suffers from a physically difficult processor upgrade and a surprisingly weak video subsystem. Integrated Ethernet may save it, though.

537 ON READER SERVICE CARD



The ZDS Z-Station 420SEh

Zenith's own EISA motherboard has four empty plugs for future additions, such as a Windows Accelerator Module (WAM); it also has a socket for a proprietary SCSI connector to as-yet unannounced peripherals. ZDS uses its own flash BIOS. The motherboard carries the processor and memory but currently lacks an external cache, though it accepts from 1MB to 128MB of RAM. A 212MB Western Digital Caviar IDE with an internal 64K buffer graces the 420SEh. The integrated video is based on a Western Digital chip set with 512K of video memory; The 420SEh's uninspiring 14-inch monitor is unable to go beyond 640-by-480 or 720-by-400 resolution.

Upgrading the 420SEh requires removing the drive assembly and drives and replacing the processor. The autosensing circuitry does the rest.

We tested the 420SEh with a 486DX/33 and 486DX2/50 processor; it produced consistently average results except for Windows graphics, where it trailed under both processor platforms. If you want to use this as a Windows machine, look into Zenith's WAM, which is $179 if ordered with the PC.

A one-year parts-and-labor warranty and on-site service round out this system.—*OR*

Zenith Data Systems

ZDS Z-Station 420Sn

The smallest member of Zenith Data Systems' upgradable Z-Station family, the $2,517 486SX/20 ZDS Z-Station 420Sn produced competitive performance, but upgrading could have been easier.

The 420Sn's tiny, attractively styled slimline case is made almost entirely of

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William D. Harrel, Windows Magazine, July, 1992

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Luisa Simone, PC Magazine, August, 1992

" CorelDRAW 3.0 is without doubt the most powerful, feature-laden, and best value for money graphics systems for Windows, at any price point. Full stop, end of discussion."

Jon Honeyball, Windows Magazine UK, August, 1992

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Christina Wood, PC WORLD, July, 1992

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Mike Heck, INFOWORLD, July 13, 1992

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John Butler, Seybold Report on Desktop Publishing, July, 1992

"CorelDRAW is a phenomenal bargain."

Michael Burgard, PC/Computing, July, 1992

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Software Publishing Corporation	Harvard Draw	Harvard Graphics Windows	Not Available	62	1600	$1190
Aldus	Freehand	Persuasion	PhotoStyler	12	305	$1885
Corel	CorelDRAW!	CorelDRAW!	CorelDRAW!	256	14,000	$595

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CIRCLE 265 ON READER SERVICE CARD

plastic, which is lightweight but has a somewhat flimsy feel. It holds one internal 1-inch-high IDE or SCSI drive bay and one accessible 1.44MB floppy disk drive. The power switch is on the side, and there are no turbo or reset switches.

The 420Sn uses a ZDS motherboard and a flash-upgradable system BIOS. Its 8MB of RAM (64MB is the on-board maximum) lacked an external cache. The hard disk was a Western Digital Caviar 212MB IDE with an internal 64K cache. Disk control was motherboard-resident, as were the I/O circuits and video, leaving you with two empty vertically stacked ISA expansion slots. Also on the motherboard are sockets for three proprietary plug-in modules: a SCSI connector, high-speed communication device, and a Windows accelerator. Video, based on a Western Digital chip set with 512K of video memory, was paired with an unimpressive 14-inch ZCM monitor that displays only 640-by-480 and 720-by-400.

After you replace the 420SEb's processor, the autosensing circuitry takes care of the rest.

Because everything pops in and out fairly easily, ZDS engineers must have figured it would be acceptable to place the LIF (low-insertion-force) socket underneath the drive bays. Removing the drive assembly wasn't hard, but disconnecting all the drives was time consuming. The system documentation needs revising as well. ZDS apparently targeted the 420Sn at beginners and wrote the manuals to match, leaving out information necessary for more experienced users. Also, a jumper switch setting for the hard disk was erroneous.

The ZDS Z-Station 420Sn

The 420Sn ran our benchmark tests with a 486SX/20 and 486DX/33 processor. Its performance was average except under Windows, where it placed near the bottom.

ZDS includes a noteworthy new feature with all its Z-Station models: integrated networking. The Ethernet NE2000–compatible LAN module in the 420Sn requires only a media adapter to be up and running. Client shells for NetWare, Microsoft LAN Manager, and Banyan's VINES are preinstalled on the hard disk. ZDS includes a one-year parts-and-labor warranty; on-site service is free for the first year.—*OR* □

FACT FILE

ZDS Z-Station 420Sn

Zenith Data Systems, 2150 E. Lake Cook Rd., Buffalo Grove, IL 60089; 800-553-0331, 708-808-5000

List price (tested configuration): 486SX/20, $2,517; 486DX/33 upgrade, $959

Memory and processor RAM cache: 8MB 80-ns SIMMs

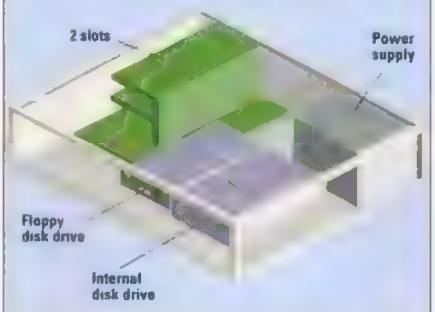
Disk drives and controller: Western Digital Caviar 2200 IDE 212MB hard disk with internal 64K cache, ZDS integrated controller, 1.44MB floppy disk drive

Display: ZDS integrated video with a WD 90C30 chip set and 512K video memory, Zenith ZCM-1410 monitor, 60-Hz refresh rate at 640-by-480

Software: DOS 5.0, Microsoft Windows 3.1, Microsoft LAN Manager 2.1, NetWare 3.11, VINES 4.11.0

In short: This PC is slightly frustrating to upgrade, but this drawback is balanced by its integrated Ethernet networking

538 ON READER SERVICE CARD



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In still other words, the new COMPAQ ProSignia.

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COMPAQ ProSignia disk-configured models come standard with an all-new 32-Bit Fast-SCSI-2 Controller that performs twice as fast as old SCSI technology. As well as a preinstalled, COMPAQ 32-Bit NetFlex Controller that works with Ethernet or Token Ring. And for those who require truly

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intel inside

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Drives. **This service, provided by Contracted Service Providers, is specific to hardware products and may not be available in certain geographic locations. Consult the Compaq Customer Support Center for details. †Suggested retail price, reseller price may vary; price indicated is for non-disk-configured COMPAQ ProSignia 486/33 Model 1/EL, not pictured here; monitor, NetFlex Controller not included. Models including hard drive and NetFlex Controller start under $4500. The Intel Inside logo is a registered trademark of Intel Corporation

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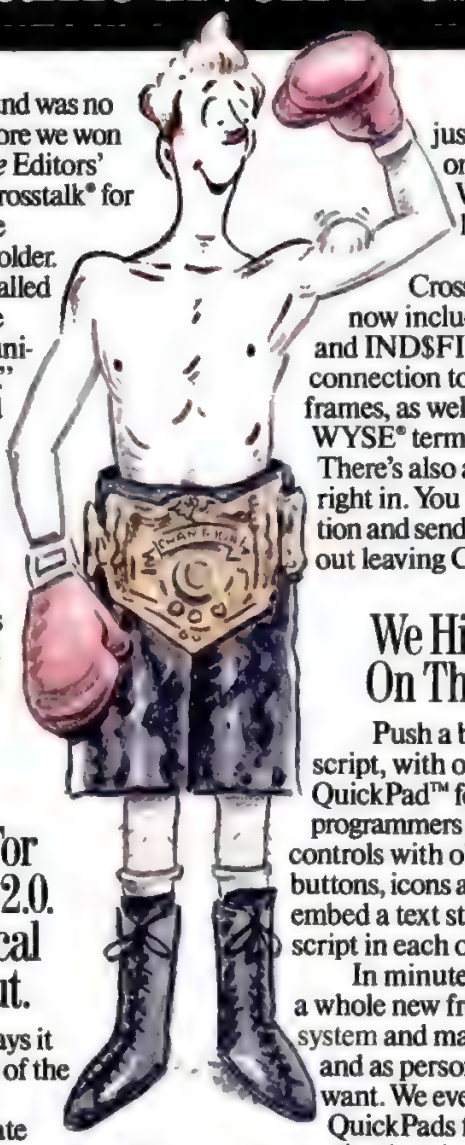
The Heavyweight Champion Of Windows Comm Software Just Became Even More Of A Knockout.



The first round was no contest. Long before we won the *PC Magazine* Editors' Choice Award, Crosstalk® for Windows was the undisputed title holder. *Software Digest* called it the "best of the graphical communications packages." *InfoWorld* named it "Product of the Year." And it won the *Windows Magazine* Readers' Choice Award.

But for all its power, we knew it had the potential to pack an even bigger wallop.

New Crosstalk For Windows 2.0. A Technical Knockout.

PC World says it "jumps far ahead of the last version" and "advances the state of the art in modem software." And you can see the difference the minute you start it up. The interface is more functional, more convenient and just downright fun to use. A new QuickBar™ tool menu turns common tasks like downloading a file into a simple matter of clicking on an icon. And it follows Windows™ 3.1 interface standards to the letter.

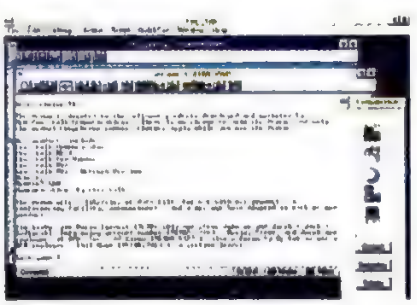
But we didn't just put a new face on an old program. We also taught it a lot of new tricks.

For instance, Crosstalk for Windows now includes FTTERM and IND$FILE support for connection to IBM® mainframes, as well as HP® and WYSE® terminal emulation. There's also a text editor built right in. You can edit information and send it out again, without leaving Crosstalk.

We Hit It Right On The Button.

Push a button and run a script, with our new object QuickPad™ feature. Even non-programmers can design custom controls with objects such as buttons, icons and pictures. Then embed a text string or an entire script in each object.

In minutes, you can design a whole new front end for a host system and make it as friendly–and as personalized–as you want. We even include pre-built QuickPads for accessing and navigating the major on-line services.



Windows within Windows: QuickPads float on your screen, ready to run entire scripts at the push of a button.

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> *—PC World, October 1992*

You can even import dialing directories from the DOS version of Procomm Plus.™ (We want to make everything easy for you, including *switching* to Crosstalk.)

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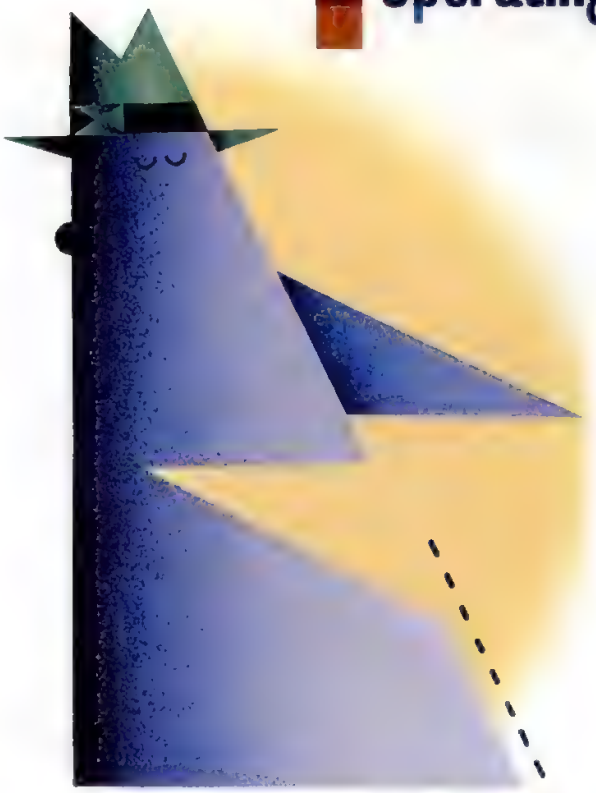


With Windows for Workgroups, the familiar Windows interface provides seamless access to a built-in peer-to-peer network with network-wide DDE, electronic mail, and sophisticated scheduling software.

Windows *for* Workgroups

The Apple Macintosh with its built-in networking set the pace, but now the components needed to network PCs are becoming standard equipment. LAN adapters are now so inexpensive that many manufacturers are shipping them with the computer, just like video adapters and hard disk controllers.

Microsoft's new Windows for Workgroups acknowledges the emerging importance of networking; it provides an enhanced version of Windows 3.1 with seamlessly integrated peer-to-peer networking. And you need not fret about hardware: If you're a current Windows 3.1 user, Windows for Workgroups can be

by Frank J. Derfler, Jr. and Steve Rigney

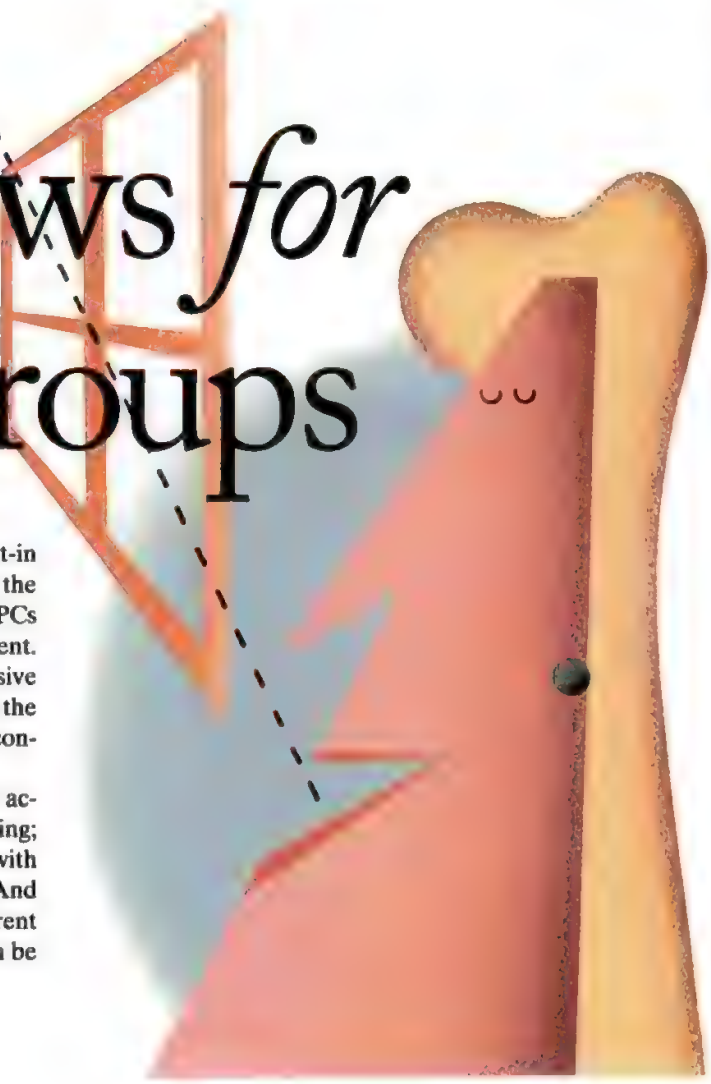


Illustration by Terry Allen

purchased with two network cards and cable for $549.95.

Windows for Workgroups is designed in every way to make networking painless and easy. Installation is virtually automatic, and once it's installed you get peer-to-peer file sharing and peripheral sharing, network-wide DDE (Dynamic Data Exchange) and OLE (Object Linking and Embedding), a bundled group scheduler and mail package, and hooks to the major networking packages—all accessible via the familiar Windows 3.1 interface.

Less comprehensive in its security and network management capabilities than the soon-to-be-released Windows NT, Windows for Workgroups competes with such packages as Artisoft's LANtastic and Sitka's 10NET. With Windows for Workgroups' striking ease of use, simultaneous NetWare access, and massive distribution potential, the traditional peer-to-peer vendors will be hard-pressed to stay ahead of the Microsoft juggernaut.

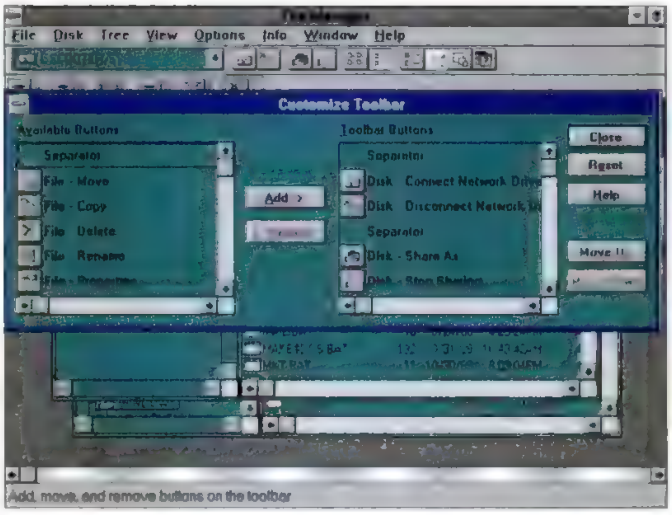
DDE ACROSS THE NETWORK

Windows for Workgroups is the first network operating system to provide full support for DDE, which allows programs to exchange messages and data across the network in exactly the same way as on a standalone machine. With DDE, people can link specific parts of spreadsheets, drawings, text files, and other types of data objects into documents and presentations on other networked machines. When a spreadsheet or drawing is changed, DDE reflects the change wherever the element has been incorporated. (For a description of how objects are shared across the network, read the sidebar "Network DDE: A Tutorial.")

In Windows for Workgroups, the familiar Windows Clipboard is enhanced with a multipage "ClipBook." ClipBook pages can be shared with other users just as files, printers, or other network resources can, and they can be password-protected. The traditional Clipboard still exists as an MDI (Multiple Document Interface) within the ClipBook.

DDE links can be easily established through menus and the ClipBook using Cut, Paste, and Paste Special in the exact same manner as you would use DDE in a standalone Windows environment. But the ClipBook is not necessary to take advantage of DDE. You can also use the macro language of the client application to create the links. The macro languages of Microsoft Excel, Microsoft Word for Windows, Lotus 1-2-3 for Windows, and virtually any other Windows program that supports OLE can make DDE calls. Since the current version of OLE (Version 1.0) is based on DDE, Windows for Workgroups can support OLE "for free" just by supporting DDE. OLE, Version 2.0 (which is scheduled for release in January 1993) will no longer be based on DDE, but Microsoft promises that Windows for Workgroups will continue to support it.

We sometimes obtained unexpected results in our testing of network-wide DDE, but the problems were sporadic and we were unable to duplicate them. Like standalone DDE before it, it will probably take a few go-rounds for Microsoft to iron out the kinks.



The File Manager toolbar now has special icons for connecting and sharing network drives. You can customize these icons; many network administrators will choose to remove them from the toolbar to prevent accidential disconnects.

MAIL AND SCHEDULING

Windows for Workgroups includes a stripped-down version of Microsoft Mail for PC Networks, Version 3.0, that lets you handle the usual electronic mail chores and acts as an underlying engine for other workgroup applications. But it lacks the spell-checker and many of the Post Office management features (such as deleting all messages older than a certain date with a single command) of the full Microsoft Mail package. It also can't transmit across gateways. If you want to talk to other mail systems or remote callers, you'll either need the full version of Microsoft Mail or you'll need to add Microsoft's Mail and Schedule+ Extensions for Windows for Workgroups ($495), which adds connections to gateways.

Microsoft Schedule+, an application built on the e-mail engine, ships with Windows for Workgroups. This is a full-strength network scheduling program that lets you maintain a local calendar while coordinating appointments with others in your workgroup. The package shows conflicts in the calendars of people you want to invite to meetings, suggests free times, and provides reminder alarms and all of the other expected functions. While there are a number of other network scheduling programs on the market—Network Scheduler and On Time, for example—none has the tight integration with Windows that Schedule+ offers.

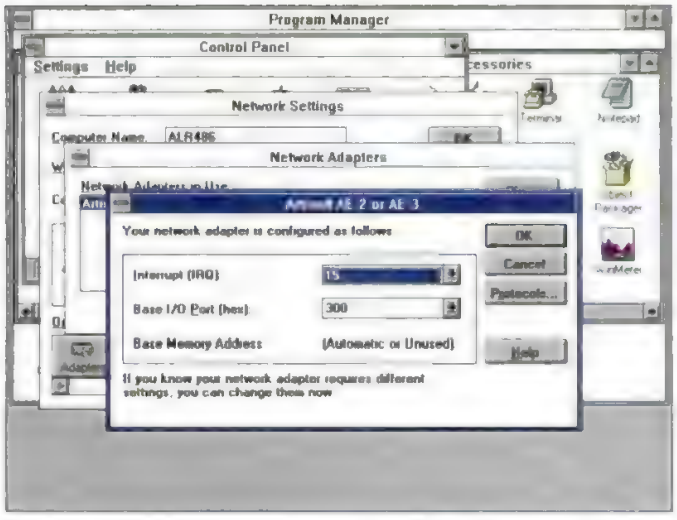
Schedule+ and Microsoft Mail are Microsoft's first workgroup computing

FEATURES PLUS

Join *PC Magazine*'s Frank J. Derfler, Jr., and Microsoft product executives in ZiffNet's Executives Online Forum for a discussion of Windows for Workgroups—starting Monday, November 30 through Friday, December 4. You can follow the action by typing GO ZNT:EXEC at any CompuServe ! prompt.

Our Contributors: FRANK J. DERFLER, JR. is senior networking editor of *PC Magazine*. LES FREED is the founder and former CEO of Microstuf (now Digital Communications Associates' Crosstalk division) and frequently writes on networking topics. STEVE RIGNEY is a network consultant based in Florida and a frequent contributor to *PC Magazine*.

applications, and Microsoft is planning to release other applications that use the e-mail engine in the near future. The first scheduled to be released is a forms program that has automatic routing capability, so that a process such as accepting a credit application can be initiated by one person and routed automatically and simultaneously to the other people who are part of the approval process. A toolkit for designing your own forms is in the works, and there are plans for document management/workflow applications. Microsoft hopes that third-party vendors will also release programs that use the e-mail engine.



The familiar Control Panel now contains network configuration options. In this example, the program has detected an Artisoft AE-3 network adapter; factory default IRQ and address settings appear automatically. Since the AE-3 isn't set through software and Windows for Workgroups cannot detect jumper settings, you must enter changes manually if you have changed the default configuration on the adapter card.

AUTOMATIC INSTALLATION

Peer-to-peer networking differs from server-based networking in that there is no dedicated server. Any workstation on the network can act as both a client and a server, depending on whether it's using remote resources or sharing its own with remote computers.

Our recommended setup for a Windows for Workgroups server is a 386DX/33 with 8MB of RAM (though Microsoft recommends 4MB) and at least a 200MB IDE hard disk. While this is steeper than the hardware requirement of competitive products, the requirements are due to Windows itself, rather than the networking component. Any workstation publishing its resources must be running Windows for Worgroups in enhanced mode, necessitating at least a 386SX.

If the PC sits idle most of the time and network use is light, then even a 386SX/25 with 4MB of memory will probably be adequate. But if the user keeps multiple applications open while actively entering keyboard information and making heavy use of the shared hard disk, then the fastest available processor with perhaps 32MB of RAM is in order. During our testing, which put plenty of strain on the system, the importance of adequate memory for respectable processing speed became clear. PCs with 16MB or even 8MB of RAM snapped screens into place, while otherwise identical machines with 4MB of RAM took much longer to draw them.

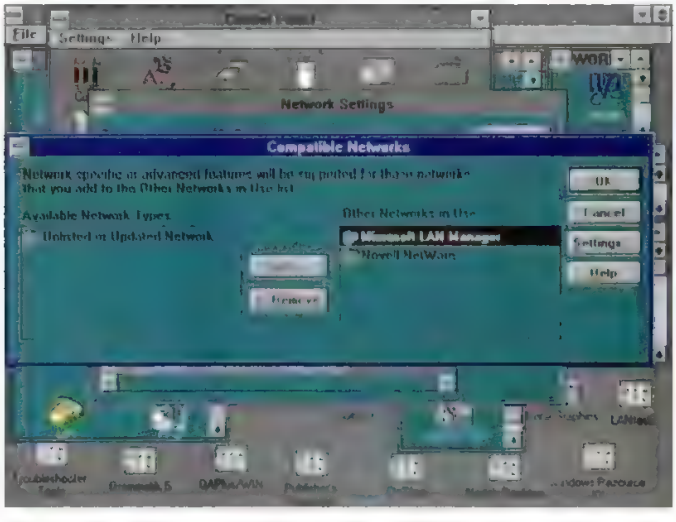
Installing new network software is usually left to experts, but Windows for Workgroups makes it as painless as possible with its unique ability to recognize and automatically load drivers for over 150 different makes and models of LAN adapters. If the adapter can be configured by software, then Windows for Workgroups takes care of everything. If the adapter uses jumpers or switches, you are asked to confirm the default factory settings or enter new settings.

It's easy to choose which network resources to use and share. The File Manager and Print Manager programs have two new menu selections—Share and Connect—which are also found on the toolbar. Network resources appear as additional drive letters or LPT ports and work in the same way as local resources. For example, you can use the drag-and-drop file-transfer feature of the Windows File Manager on all networked and local drives.

WORKING WITH OTHER LAN SOFTWARE

Windows for Workgroups works with a large number of networks right out of the box, and Microsoft went out of its way to ensure that the list included Novell's popular NetWare operating system. In fact, NetWare client software and drivers are bundled with Windows for Workgroups, and menu-driven NetWare installation is built into the software. (You can also choose to load NetWare after installing Windows for Workgroups.)

Microsoft made a smart move in bundling client software for Novell's NetWare into Windows for Workgroups. Under Windows for Workgroups, you can simultaneously log on to other PCs and to NetWare servers. Users on the network can elect to make disk drives, shared printers, or CD-ROM drives available through Windows for Workgroups while everyone still uses the dedicated server for primary file operations. The NetWare server can even host the



You can add or delete network drivers during installation or whenever you need to reconfigure the network. The Windows for Workgroups client software need not be loaded (you could, for example, choose to run only NetWare), but you would lose the peer-to-peer and ClipBook sharing capabilities of Windows for Workgroups.

Getting the Most from Windows for Workgroups

by Les Freed and Steve Rigney

Although Microsoft Windows for Workgroups makes networking easier than it has even been before, you are still likely to encounter some difficulties and surprises. These 15 tips will help make using Windows for Workgroups as easy as possible.

1. INSTALL FROM A FILE SERVER

Like the single-user version of Windows, you use the SETUP.EXE program to install Windows for Workgroups. An improved network setup option lets you copy the master Windows disks onto a file server and then install additional systems from the master copy on the server. This process takes up 14MB to 15MB of space on your server, but if you have more than a few machines to install, it saves hours of tedious disk-swapping.

2. PLAN YOUR LAN

If a PC is marginally equipped to handle Windows in terms of processing power, disk space, and RAM, don't even think about making it a Windows for Workgroups server. If, however, there is a PC with a hard drive that is largely unused (nature abhors a vacuum!) it makes sense to make that drive available for sharing. It also makes sense to share printers attached to PCs in convenient locations. Not every network resource has to be shared.

3. PLACE YOUR PRINTERS

The ability to share printers is a valuable benefit. You can give DOS-based PCs the ability to host remote printers using Intel's LANSpool software. Intel has a version of LANSpool for Microsoft LAN Manager that you can use to make printers attached to DOS PCs available to receive print jobs across the network.

4. PUMP UP YOUR PRINTERS

Adding memory to a shared printer will reduce the drain on the servicing PC. Even a relatively low-powered PC can be a good print server and still allow someone to run applications if the printer takes the print job quickly. Adding memory is easier and less expensive than adding another print server.

5. ATTACHING LAPTOPS

Windows for Workgroups includes drivers for Xircom external LAN adapters, but you'll probably need to take manual steps during the installation because there is no practical way the software can detect the presence of the external adapters at the parallel port. Other manufacturers of external adapters, such as D-Link Systems and Megahertz Corp., also offer NDIS drivers, but you might have to either edit CONFIG.SYS to add the correct drivers or choose the "Unlisted or Updated" section of the LAN adapter installation menu to read in .INF files provided by the manufacturer of the external LAN adapter.

6. USING ARCNET

Many people use ARCnet LAN adapters because of their low cost and efficiency. Windows for Workgroups can work with ARCnet adapters, but you cannot use both Windows for Workgroups and NetWare simultaneously with ARCnet cards.

7. PLAYING THE NAME GAME

During the installation, you must supply lots of names—computer name, group name, user name—in many contexts. To keep track of all the names, it helps to have a naming system. The simplest system is to use the same name for the person and computer. For organizations where the PC stays put when a person changes jobs, you might consider using job titles, telephone numbers, office numbers, or some other unique identifiers as the computer names.

8. SELECTING THE POST OFFICE

The machine on the network that holds the "Post Office"—a shared subdirectory usually called WGPO—must be up and running at all times for the mail system to work. So you should put some thought into the selection of your Post Office machine (or "mail server"). If you want to use a NetWare or LAN Manager server to host the Post Office, first redirect a drive to that server's subdirectory and then start the mail program. You might have to erase the MSMAIL.INI file to blank the mail program's memory and get it to accept the desired path.

9. SHARING CD-ROM DRIVES

Windows for Workgroups allows you to share CD-ROM drives across the network, but there have been problems with the Microsoft MSCDEX.EXE driver software. Make sure you are using an MSCDEX.EXE dated February 4, 1992, or later. Also, note that sharing CD-ROM data on a network violates the license provisions of many products, and that some products include specific code to prevent it.

10. RESELECTING LOST RESOURCES

If you lose a connection to a shared resource like a disk drive or printer, it will appear as a grayed-out icon in the File Manager or Print Manager selection box. To attempt reconnection, simply double-click on that icon; you don't have to go through the menu-driven connection steps again.

Continues on page 260

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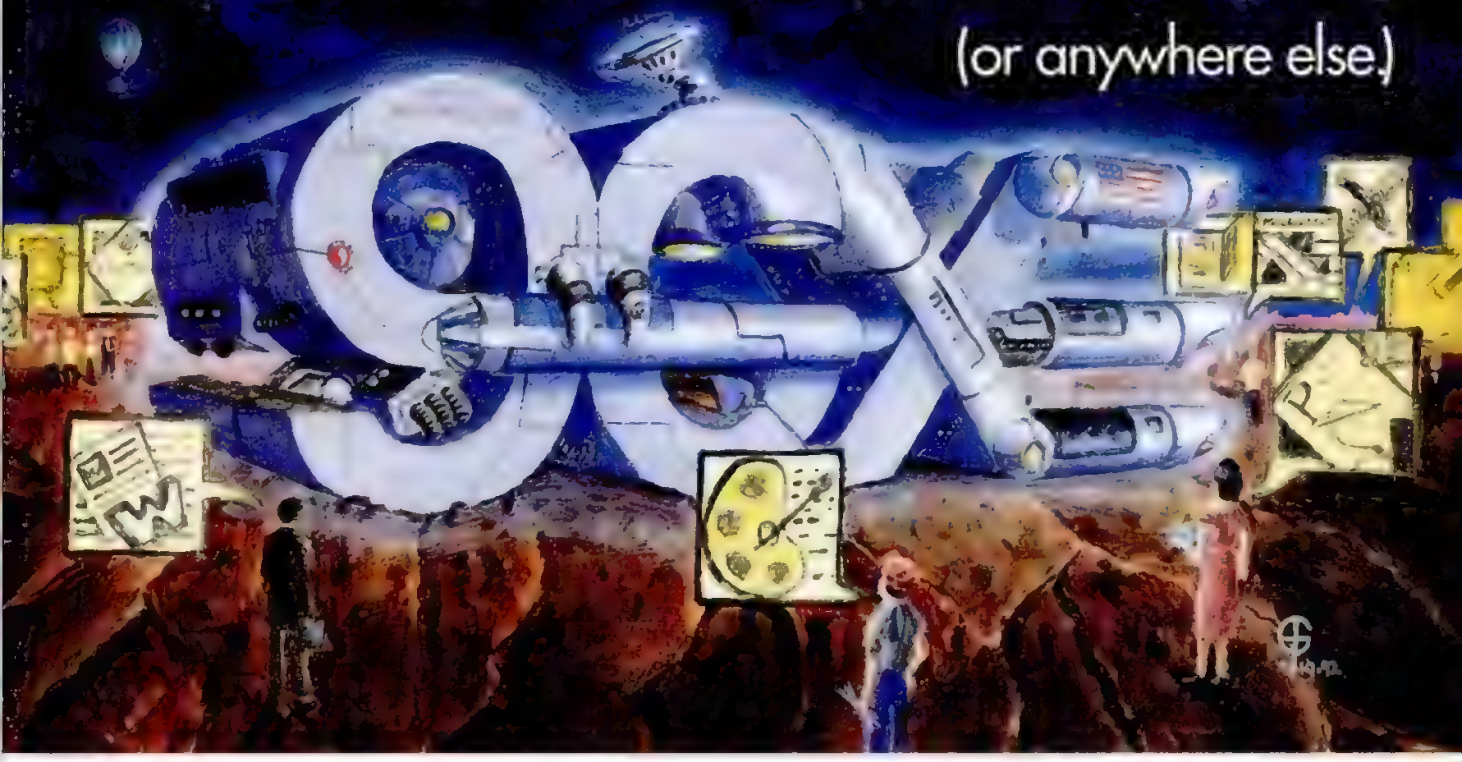

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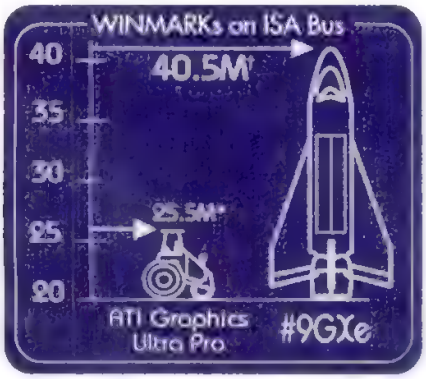

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S3

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Getting the Most

CONTINUED FROM PAGE 258

11. MAKING THE MACINTOSH CONNECTION

Windows for Workgroups doesn't directly support Macintosh clients, but Macs attached to a LAN Manager network or NetWare network can still share files with Windows for Workgroups machines.

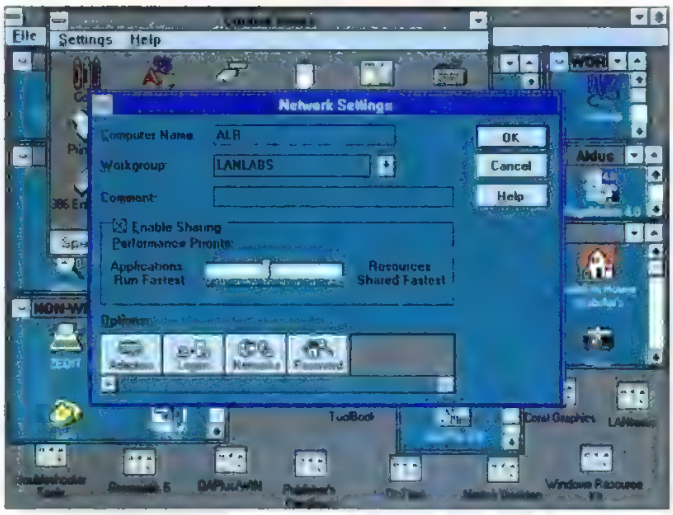
For LAN Manager networks, you'll need a copy of Microsoft's LAN Manager Services for Macintosh. This $995 product works only with LAN Manager 2.1 and allows up to 50 Macs to connect to a LAN Manager server. LAN Man/Mac supports Macintosh connections via LocalTalk, Ethernet, and Token-Ring cable. Before Mac users can use network files, the system administrator must create one or more Macintosh volumes on the network. A volume is simply a directory on the server's hard disk that is available to Mac users. LAN Man/Mac allows you to publish the same volume for both Mac and PC users; the volume may appear under different names to each type of user. For example, the directory C:\MAILLIST can appear as "MAILLIST" to PC users, and as "Mailing List" to Mac users.

LAN Man/Mac includes a slick feature called extension mapping that allows PC files stored on the network to appear to Mac users with their correct Macintosh file type and creator information. This allows the Mac users to open PC data files by clicking on an icon. For example, Mac users will see .XLS files as Excel icons, and .DOC files as Microsoft Word icons. LAN Man/Mac comes with several file types predefined, but you can add or delete other file types as needed.

For NetWare 3.1 networks, you'll need Novell's $895 NetWare for Macintosh. Like the LAN Manager product, NetWare for Macintosh installs on your server and supports Mac clients via LocalTalk, Ethernet, or Token-Ring connections.

While NetWare for Macintosh performs well, it lacks the extension mapping features found in LAN Man/Mac. The result is that Mac users must manually open shared files from the File Open dialog box, rather than by clicking on the file's icon.

In either case, you'll find that many Mac and PC applications are quite compatible. For example, Microsoft Word for Windows 2.0 can read and save Word for Macintosh files. Similarly, PC PageMaker users can open files created on the Mac, and vice versa. Many other products have this type of built-in cross-platform compatibility, including Microsoft Excel, Lotus 1-2-3, WordPerfect, and PowerPoint.



The sliding Performance Priority bar allows you to apportion processing resources between network and local applications, preventing a busy network from excessively slowing your local applications.

12. RETAINING PRIVACY

Remember that systems like Windows for Workgroups can keep people out of files when they try to gain access through the network, but anyone using the file-server PC locally can get at all files.

If you have documents or data you don't want anyone else to see, keep them on your own hard disk and not on any machine acting as a file server.

13. BEING A GOOD HOST

If someone across the LAN is using the hard disk on your PC to store files, your responsibility is to keep your PC running or to bring it back up quickly if it freezes or loses power. Don't run applications that you know will sometimes freeze when someone is counting on you as a server. Use the "Netwatcher" utility in Windows for Workgroups to see who is attached to your resources. If your system does go down for some reason, bringing it back up quickly will help reestablish contact. Windows for Workgroups will automatically try to reestablish broken connections.

14. DIALING YOUR POWER

Under the Network Settings icon in the Control Panel section, you'll find a slide bar that allows you to adjust how your CPU shares its time between servicing the network and running local applications. If someone is writing a lot of data to your hard drive while you're typing, you'll be disconcerted to see your characters appear on the screen in spurts as the CPU finds time to service the keyboard buffer. A fast typist can fill up the keyboard buffer if someone on the network is heavily using the disk drive. You won't see any difference in performance on most PCs unless both the local and networked sections are busy, but this slide bar provides a gentle way to get back some processing power if you can't stand the slowdown.

15. SHARING A PC

In many organizations, people share the same PC and use it for different tasks. Windows for Workgroups is awkward in such a situation because it doesn't have provisions for personalized login scripts or profiles; the machine comes up in the last standard setup. You can establish a LAN Manager or NetWare server that offers personalized login files. □

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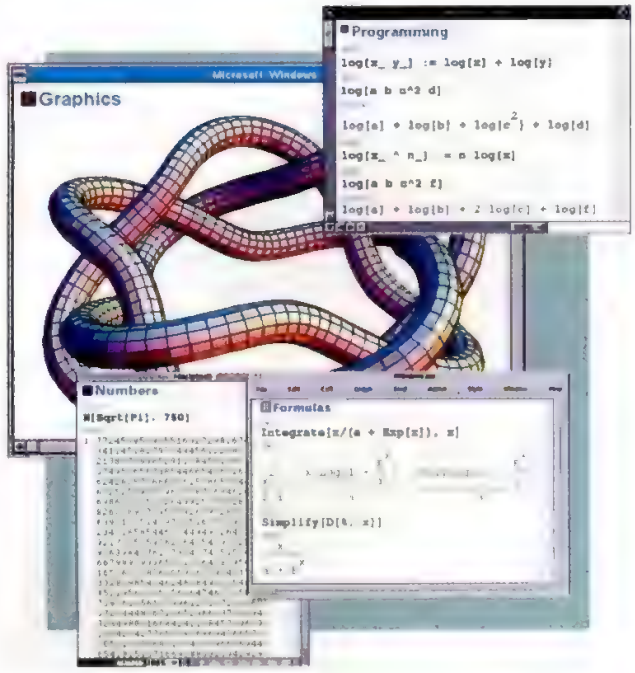

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Microsoft Mail network mailbox file subdirectory.

In short, present users of NetWare can add the functions of Windows for Workgroups without losing the dedicated NetWare features. You can have the data-sharing features of Windows for Workgroups and the elaborate server management, communications, and routing features of the more powerful server software at the same time.

Windows for Workgroups uses Microsoft's Network Driver Interface Specification (NDIS). Before NDIS became a standard, you needed separate transport protocol implementations for each network card. With NDIS, one driver can talk to all interface cards. As long as a network operating system is NDIS-compliant and NetBIOS-compatible, you can connect to it through Windows for Workgroups. Since Novell's IPX transport protocol was not NDIS-compliant, Microsoft worked with Novell to develop an NDIS-compliant version, and it is included with Windows for Workgroups.

By default, Windows for Workgroups uses the NetBEUI (NetBIOS Extended User Interface) transport protocol, so other networks that default to NetBEUI (such as Microsoft LAN Manager and IBM LAN Server) will be detected automatically. Connecting to network operating systems like Pathworks and 3+Open, which default to other protocols, is not automatic but can be easily achieved. Since Windows for Workgroups uses the Microsoft Server Message Block (SMB) application-level protocol, if you want to connect to a network that doesn't use the SMB you'll have to load a second redirector. The only third-party redirector currently provided is NetWare's. Microsoft is looking to work with other vendors, as well, so that more redirectors will become available in the future.

And if you're logging on to many networks, Windows for Workgroups can help you with the problem of remembering a lot of passwords. You only have to enter passwords once, and then Windows for Workgroups can use password caching to store the passwords in memory and log on for you.

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Network DDE: *A Tutorial*

by Steve Rigney

The most interesting feature of Windows for Workgroups is the ClipBook, which allows DDE (Dynamic Data Exchange) links between applications across the network. Programmers can establish invisible links through macros, but a series of menus allows even moderately experienced users to set up

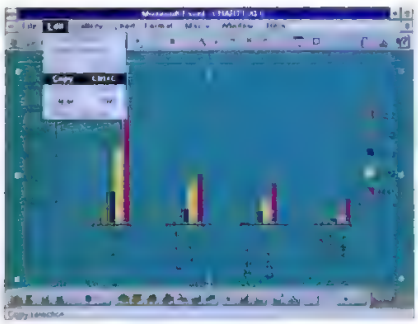

Figure 1: **The first step is to designate the text or graphic to be linked by dragging the cursor across it while holding down the left mouse button. Then choose Copy from the Edit menu.**

Figure 2: **After copying the object into the Clipboard, activate the ClipBook Viewer by selecting its icon from the Main group in the Program Manager.**

Figure 3: **Choose the Paste command from the ClipBook Edit menu so that you can paste the object from the Clipboard into the ClipBook.**

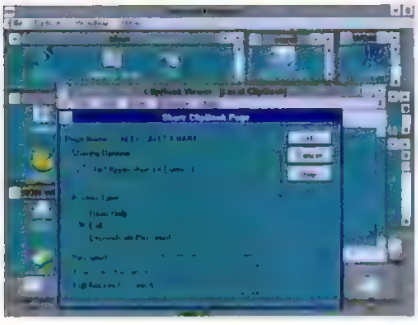

Figure 5: **The Share ClipBook Page window appears. You can choose to launch the linked application automatically by choosing the Start Application on Connect option. Access can be password protected on a page-by-page basis.**

Figure 6: **The object is now available in the ClipBook Viewer to any authorized PC running Windows for Workgroups. To link the object to a Microsoft Word document on another networked PC, first select the ClipBook Viewer.**

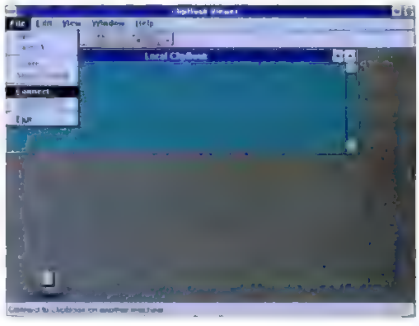

Figure 7: **When the ClipBook window opens, select the Connect command from the File menu. This is a necessary step. The ClipBook is a resource that can be shared across the network just like files or printers.**

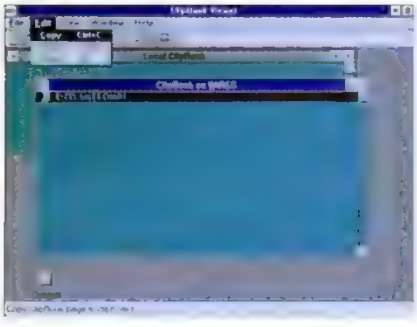

Figure 9: **Then select the Copy command from the Edit menu. The selected object is copied from the ClipBook into the local Clipboard.**

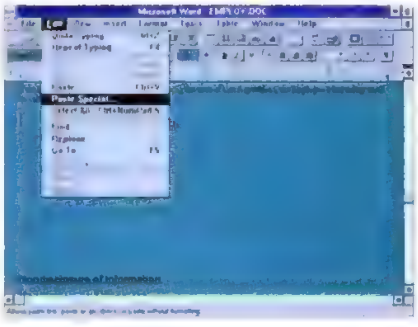

Figure 10: **To bring the object into the document or presentation, switch to the application, place the cursor where you want to insert the object and select Paste Special from the Edit menu.**

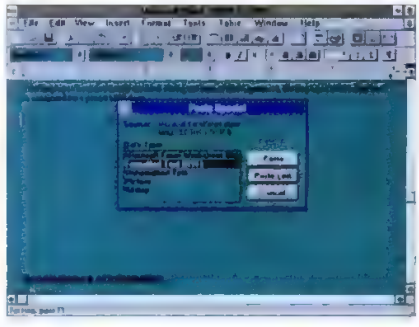

Figure 11: **In the Paste Special window, click on either Paste or Paste Link. Paste will place a read-only version of the object into your document. Paste Link inserts a pointer to the original object so that the object can be edited.**

network DDE links between applications. The sequence of menu selections for linkage isn't intuitive, however, so here we map out and explain the necessary steps.

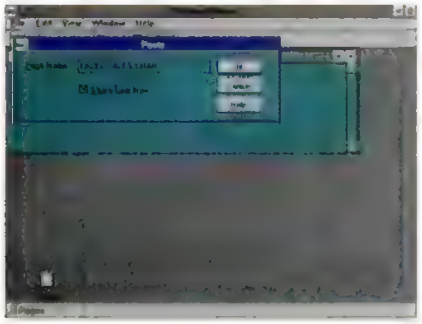

Figure 4: **In the Paste window, enter a name or description for the information you have selected to paste. Select the Share Item Now box. (An *X* appears when the box is turned on.) Click on OK.**

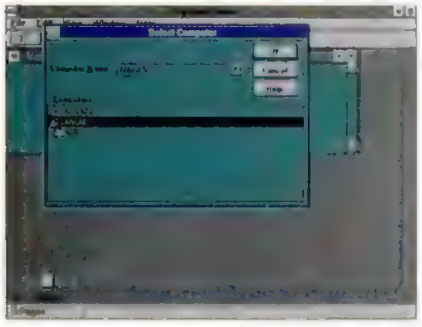

Figure 8: **The Select Computer window prompts you for a computer name. You can select a computer from the lower box or type in the correct computer name.**

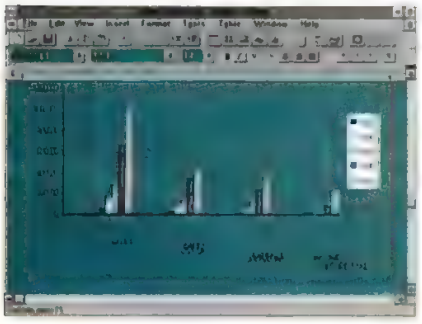

Figure 12: **The chart, created in Excel, now appears in Microsoft Word. Others on the network can also link to it. As the chart is changed in Excel, the changed image appears in all of the documents that are linked to it.**

and software options and automatically saves the configuration. Three text boxes at the top of the Control Panel let you set the machine name, workgroup, and optional comment field for the installed machine.

The sliding pointer in the center of the Control Panel adjusts the performance priority, which lets you fine-tune the number of CPU cycles devoted to networking tasks. Four icons at the bottom bring up settings boxes for LAN adapters, log-on parameters, support for other networks, and your user ID information.

In the Main menu, you will find two new utilities: WinMeter and Net Watcher. WinMeter gives you a dynamic, real-time graph of CPU usage. The utility gets the information from the Windows scheduler and it isn't very sophisticated (for example, you can't break out usage by application), but it's still useful.

Net Watcher tells you who is attached to any resources you have offered for sharing across the network and warns you of active sharings before you disconnect them or leave Windows for Workgroups. This is important, because users don't get a warning message that you've shut down your station until they attempt to gain access to your peripherals or try to save a file to your hard drive.

HOW DOES IT STACK UP?

Other companies, notably Artisoft and Sitka, have done an excellent job of integrating peer-to-peer networking into Windows. Both of those vendors' products, however, are Windows applications, whereas Windows for Workgroups actually replaces Windows; Windows for Workgroups is a full-blown graphical environment that also supports networking. With programs like LANtastic for Windows and 10NET for Windows, you can hopelessly confuse the selection of networked drives and shared resources by logging on to different server drives in separate virtual Windows sessions—something that the tight integration of Windows for Workgroups does not allow. Nor do these other products offer the ability to simultaneously run with NetWare.

Windows for Workgroups is unique in other ways, too. Its communications components are entirely written in 32-bit code. Not only does this make it fast, it means that the software can be loaded above one megabyte, eliminating RAM cram entirely. Its ability to utilize Name Servers within a peer-to-peer context is also unique, since Name Servers usually have to be specified in advance. By designating a Name Server on the fly, Windows for Workgroups is able to reduce the network load while retaining the flexibility needed for peer-to-peer networks.

But the most striking thing about Windows for Workgroups is how easy it is to install and run. The package is superbly put together; everything you need is in one box (you even get a screwdriver!) and installation is completely automated. For all the offices that have avoided networking in the past because it was too much trouble, Windows for Workgroups is a natural choice. □

FACT FILE

Microsoft Windows for Workgroups, Version 3.1

Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 206-936-8080; fax, 206-936-7329.

List price: For current DOS users: starter kit, $849.95; user kit, $424.95; Windows for Workgroups, $249.95. For current Windows 3.1 users: starter kit, $549.95; user kit, $274.95; Windows for Workgroups, $99.95. Workgroup Connection: $79.95.

Requires: 386SX-based PC or better (286 or better for machines not supplying shared files or printers), 3MB RAM (4MB recommended; 2MB required and 3MB recommended for machines not supplying shared files or printers), 10MB hard disk space, Windows 3.1-compatible video and network adapters, MS-DOS 3.3 or later. For Workgroup Connection: 8088-based PC or better, 640K RAM, MS-DOS 3.3 or later.

In short: Windows for Workgroups makes peer-to-peer networking easy with painless, menu-driven installation and operation, and it is the first network operating system to offer full network DDE (Dynamic Data Exchange) capabilities. The package includes an e-mail system and a scheduling program and is compatible with a wide range of other network operating systems, including Novell's NetWare. With its ease of use, strong feature set, and enormous distribution potential, Windows for Workgroups is poised to dominate the peer-to-peer networking market.

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★Star Trek: The Screen Saver

Beam aboard the Enterprise with Captain Kirk and Mr. Spock on a mission to prevent screen burn-in. Encounter trilling Tribbles, Klingon battlecruisers, and burrowing horta. This all new screen saver provides over 15 animated displays, password protection, System IQ and full compatibility with After Dark. **Publisher: Berkeley Systems GR5883**

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★FileMaker Pro 2.0 for Windows

For power, sophistication, simplicity, multi-platform, and multi-PC versatility, you can't do better than FileMaker Pro. It's easy to get started, yet powerful enough to accommodate even the most complex data management needs. Share data across a network with colleagues using Macintosh computers and PCs running Windows. Manage everyday functions like invoicing, mailing lists, and sales records with ease. Create compelling custom-specified reports, charts, and graphs with full color and glitzy graphics. User definable buttons, checkboxes, pop-up lists, and menus all help streamline your work. **Publisher: Claris BS7293**

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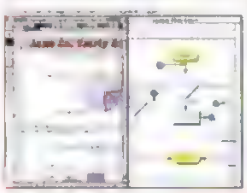
★CorelDRAW! 3.0

A new Era in PC Graphics! CorelDRAW, winner of over 50 international awards, is the PC graphics software for everyone! CorelDRAW 3.0's enhanced features include graphic design layers; editable preview; improved 3D effects; and powerful data-driven charting, paint and photo editing, and presentation packages. CorelCHART, Corel PHOTO-PAINT, and CorelSHOW. It comes with 154 TrueType fonts, and over 4600 symbols and clip art images. And as an unprecedented bonus, Corel has included a CD-ROM with over 12,000 clip art images and over 250 fonts! Also included: dozens of fill patterns, dotted and dashed line styles, and arrowheads, 31 import/export filters, free Pantone and TRUMATCH licenses, and free utility programs CorelTRACE and Mosaic. **Also Available on CD ROM. CD0580 $369. Publisher: Corel Systems GR5443/5**

$389

Mighty Draw

Mighty Draw is an object-oriented drawing program that creates pie, column, bar, and flow charts, electronic schematics, network diagrams, flyers, newsletters, greeting cards, logos, and more. Mighty Draw's extensive library of hundreds of pre-drawn symbols utilizes a library feature which provides quick access to multiple symbol libraries simultaneously. **Publisher: Abracadata GR6144**



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The UnMouse

The UnMouse does everything a mouse can—only faster, easier, and in less space. To move the cursor, simply slide your finger over the glass surface. To make a selection merely press down. The UnMouse also serves as an extended keyboard. Tap the large red button and you have a Power Keypad with 16 keys instantly available to execute macros (60 in advanced mode). With its one million touch points the UnMouse also performs as a small graphics tablet. **Manufacturer: Microtouch IN0810**

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MultiSound *Hi-res 16-bit sound card*

Winner of the 1992 WIN 100 award from *Windows Magazine*, MultiSound has been praised by critics as the best multimedia sound card available. It is the only sound card which provides audiophile quality. It offers 16-bit CD-quality hard disk recording, as well as a professional sample-player synthesizer for the only "real sounding" MIDI on the sound market. Multisound also includes a Motorola 56001 Digital Processor chip, so that future Windows applications only require a software update for support. Requires 2MB of RAM, Windows 3.1, a hard disk, and a mouse. **Also available: *Wave for Windows* UT2563 $85. Manufacturer: Turtle Beach EX2270**

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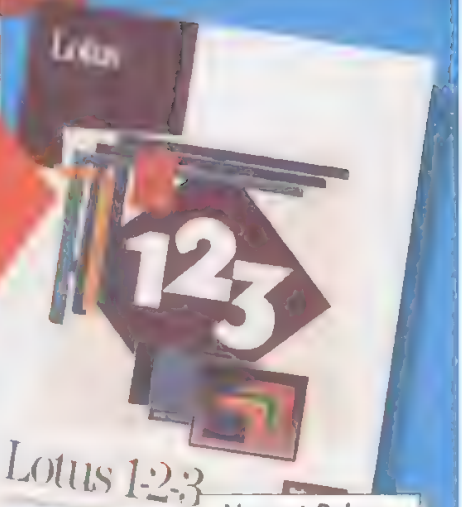

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Publisher: Aldus
GR5383

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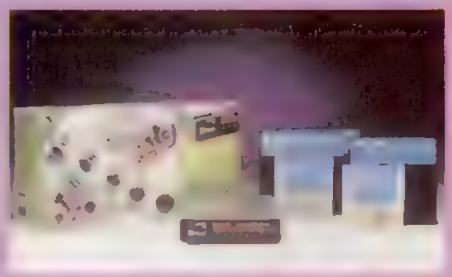
Manufacturer: Hayes MM2270



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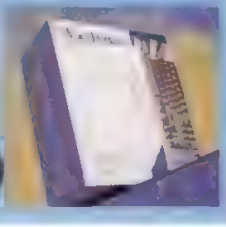
WordPerfect 5.1

WordPerfect 5.1 is easy to learn, and comes packed with features, including pull-down menus and mouse support, an equation editor, and a new tables feature. Among its high points are automatic formatting and pagination, vertical text centering, red-lining, outlining, an enriched mail merge function, a macro library, a spelling checker, and a thesaurus. WordPerfect also prints multiple columns and imports graphics. It manages long documents and can generate a table of contents, plus indexes, footnotes and endnotes.

Publisher: WordPerfect Corporation
WP0363/5



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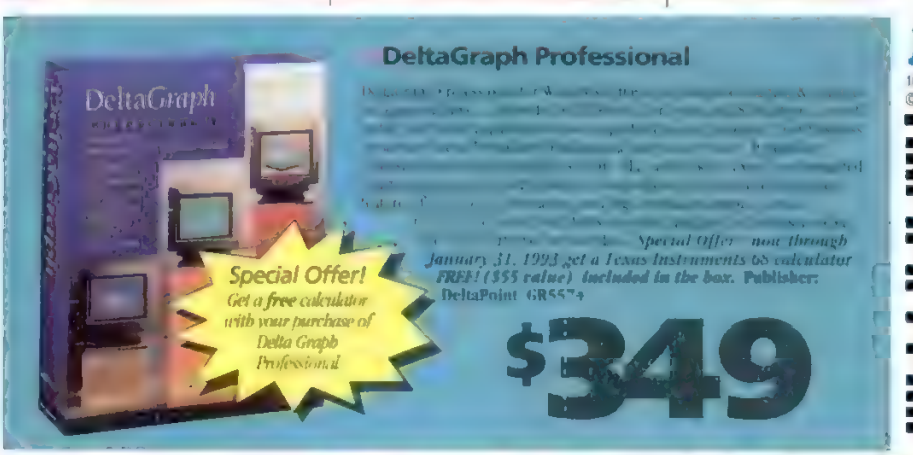

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$49

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WinFax PRO 3.0 makes it easy to send, receive, and manage faxes from within Windows. Since WinFax PRO installs just like a Windows printer, you can send faxes just as easily as you print documents... directly from Windows applications. Sophisticated document management tools let you categorize faxes using detailed descriptions, keywords, and archiving capabilities. Mark up faxes with powerful annotation tools. State-of-the-art OCR technology converts incoming faxes into editable files for your word processor or spreadsheet. WinFax includes Cover Your Fax, 50 useful and attractive fax cover sheets. Or use the new Cover page Designer and create your own. Maintain Multiple phone books and create groups for easy broadcast faxing. **Publisher: Delrina Technology FX0154**

$75

★EZCosmos 4.0

EZCosmos turns your PC into a planetarium and puts the entire universe at your fingertips. Our newest version 4.0 for Windows lets you view more than 20,000 celestial objects, including the Sun, Moon, planets and their satellites, comets, asteroids and deep space objects. Add your own items, use additional stellar databases, and even print color star charts. Our new solar system simulator lets you view the motions of the planets and their satellites as they orbit the Sun. Pin-point solar and lunar eclipses from 4,000 BC to AD 10,000 with our new eclipse and conjunction finder. Version 4.0 also has sound effects and audio clips that provide insight into what you see. **Publisher: Future Trends EN3543/5**

$42

★Presentation Task Force CGM clip art 4.0

Now you can own the clip art *PC Magazine* recently called... "The best CGM clip art package for overall quality and usability." Presentation Task Force 4.0 is the only clip art product to feature over 3,500 high quality, color illustrations in one value packed, comprehensive volume! Use PTF clip art to enhance presentations, newsletters, and spreadsheets created with over 60 leading DOS and Windows applications, including: CorelDraw!, Designer, Harvard Graphics, Microsoft Publisher, PageMaker, Persuasion, PowerPoint, Quattro Pro, Ventura Publisher, Word for Windows, WordPerfect, and many more! PTF 4.0 contains people, animals, business symbols, medical illustrations, holidays, sports, military, and environment-related images. **Publisher: New Vision Technologies, Inc. GR3174**

$134

Leading Edge VGA Color System D3/SX Plus 386-20

The Leading Edge Super VGA system uses a 20 MHz 80386SX chip, and has 2 MB of RAM, plus both 3.5" and 5.25" floppy drives and a 130 MB hard disk. It comes complete with a 14" non-interlaced VGA color monitor, a full 101-key keyboard, and a mouse. Includes MS-DOS 5.0, BASIC, Microsoft Works for Windows and Windows 3.0. Manufacturer's 12-month On-Site Warranty. **Manufacturer: Leading Edge BN1060**

$1099

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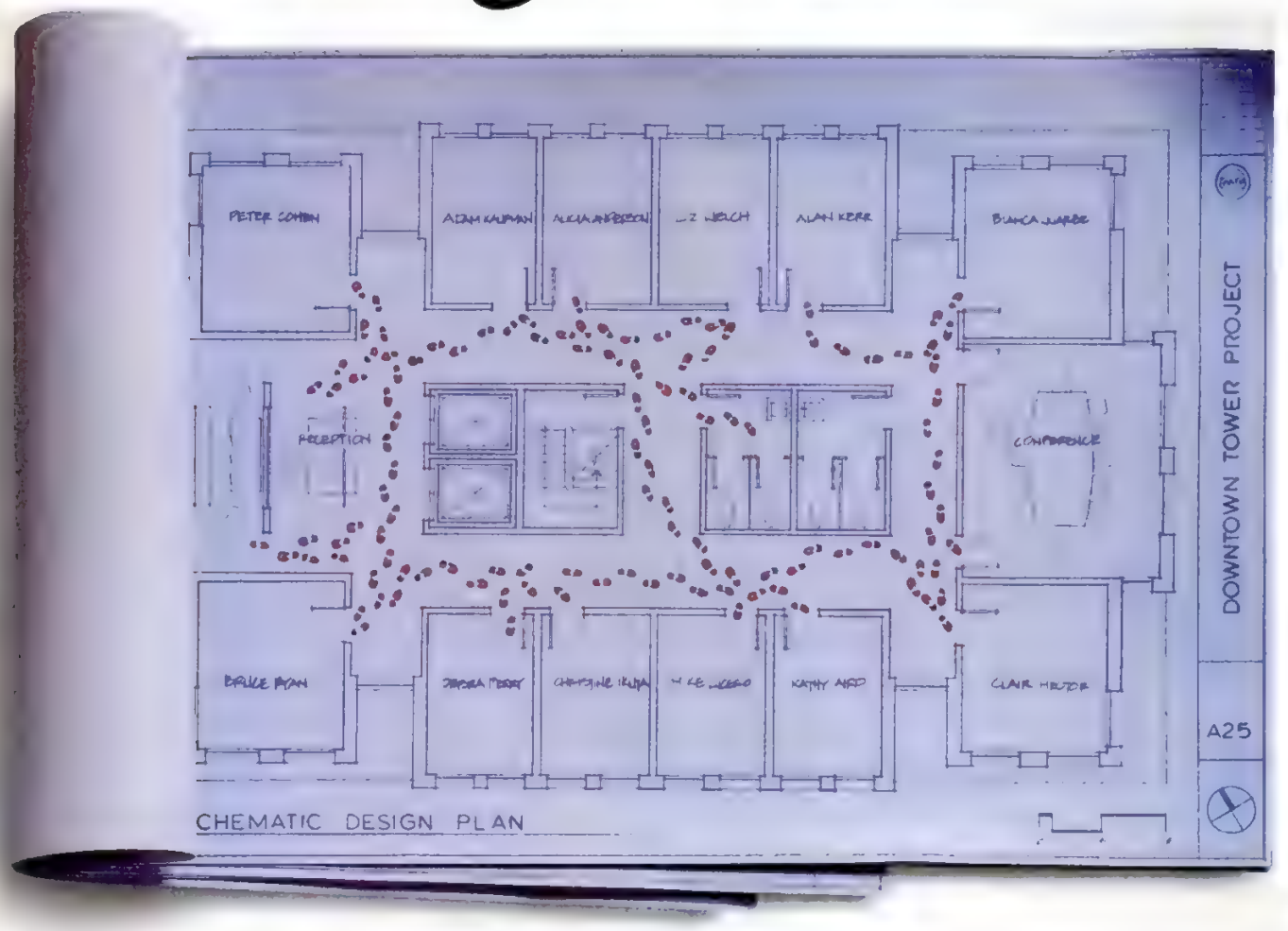

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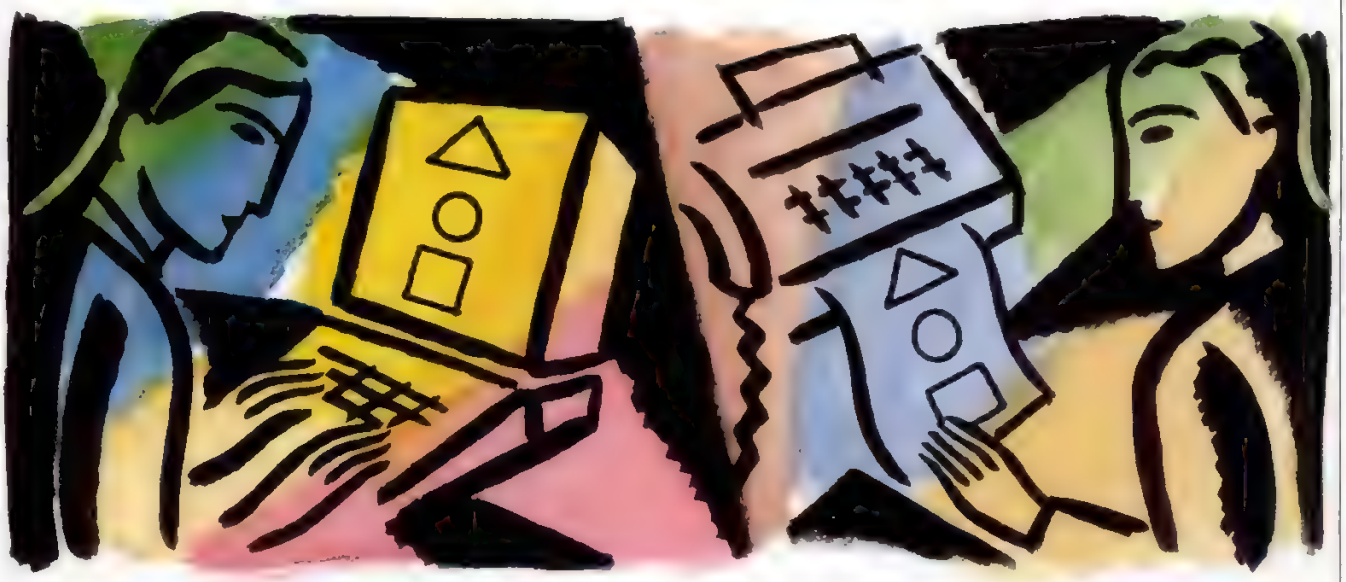
The Fax Solution

A PC fax solution requires a marriage of hardware and software. This comprehensive look at the latest products and technology in fax software and fax modems will help you find the right match.



Using a PC as a facsimile machine used to be an exercise in masochism. Anything a PC could do, a standalone fax machine could do better. Sending and receiving faxes via computer involved an excursion into a dense jungle of TSRs, printer drivers, communication ports, interrupts, and likely software conflicts.

The PC still can't match the standalone fax machine's level of simplicity, but advances in hardware and software have made computer-based faxing a viable—and in certain situations, the preferable—alternative. The PC has become a decent fax platform because of the additional features it brings to the process: plain-paper faxing at a price the dedicated fax machines can't match, fax management, and (with some caveats) a technology that translates the fax into an editable document.

For many corporate computer users, the ability to send and receive faxes at their desks means time saved: no standing in line at the fax machine, no scrounging for rolls of fax paper, no jammed machines. Computer faxing is also way ahead when it comes to broadcasting or sending a fax to a long list of people. Theoretically, you can do it from a standalone fax, but then the user interface on most

by Joel Dreyfuss

Illustration by Anthony Russo

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fax machines explains why the Japanese are still behind the U.S. in software.

To the frequent traveler armed with a laptop, a fax modem is potent ammunition. It provides the ability to communicate with customers or colleagues who are not computer users or not plugged into electronic mail, the ability to send messages and memos from a hotel room or an airport lounge, and the ability to send or receive important documents at the last possible moment.

The flurry of new products, upgrades, and beta versions we encountered in planning this article are testament to the growing popularity of PC-based faxing. Certainly sending faxes from a PC can be made easier than it is at the moment, but, even now, the benefits still far outweigh the difficulties.

A FAX PRIMER

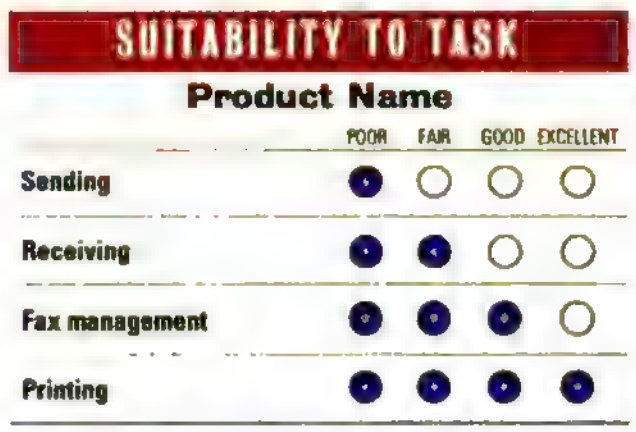
So here's a brief primer on fax technology. CCITT (Comité Consultatif International Telegraphique et Telephonique), the international governing body on communications standards, establishes rules for fax transmission. Group 1, adopted in the 1960s, allowed transmission of a page in about 6 minutes. In the 1970s, Group 2 reduced the time to transmit a page by half. Group 3, the current standard, transmits pages at a speed of 9,600 to 14,400 bits per second and incorporates various compression schemes. A typical page can be transmitted in 30 to 60 seconds. An even faster Group 4 standard with additional compression is on its way, but Group 3 is the most widely used. All the modems we tested for this article are compatible with the Group 3 standard, but they should be able to connect with the many older fax machines that incorporate Group 1 and Group 2.

The Telecommunications Industry Association (TIA), which sets standards for the interaction between computers and fax modems, defines two levels of fax modem: Class 1 (the most widely used) and Class 2 (still only a recommendation). There are two other "de facto" fax standards: CAS (Communications Application Specification), a standard for internal modems developed by Intel Corp., and Sierra Semiconductor's SendFax, an early standard for sending only. But the

Suitability to Task: Fax Software

Fax software offers many features not often found in standalone fax machines, such as scheduled sends, broadcasting, and polling. We rate 13 fax programs on their ability to send and receive faxes, manage incoming and outgoing files, and print. In each category, we evaluate both the robustness of the software and its ease of use across a spectrum of fax hardware, including standalone fax, Class 1, and CAS modems.

Sending assesses the software's ability to transmit faxes from a variety of sources to both a single recipient and to a broadcast list immediately and at a prescheduled time. Our test documents included a long text-only report, a spreadsheet containing graphics and multiple fonts, and a graphics-only document. The program should allow you to continue working while faxes are being transmitted in the background. We evaluate how each program maintains an address book of individuals and groups. When sending to a group, the program should customize the cover sheet for each recipient. You should be able to include a personalized note on each cover sheet and include graphics such as your logo. Faxing directly from an application is equally important. The software should emulate an HP LaserJet, the de facto standard for office output, so you can preview faxes before transmitting. Other important features include the ability to transfer, annotate, and forward a fax, and to send binary files to another user of the same program.



During **receiving,** the software should permit you to perform other tasks in the foreground. Here, we look at how the software notifies you when a fax has been received, and what your output options are: file, screen, or printer. In addition, the software should let you view either the whole fax at once or each individual page, and it should have various magnification levels that give greater detail. You should be able to save your faxes in a popular graphics format (such as .BMP and .PCX) for editing or other manipulation. The program should provide a detailed log of files sent and received, including details on any errors that might have occurred.

Fax management looks at how well a package stores, groups, and locates faxes. Because they are received as bitmapped images, fax files tend to be quite large. The program should offer bitmap compression or an OCR feature that will convert the bitmap into text. Flexible viewing and editing of faxes is also important. The program should allow you to edit or annotate faxes both within the application and through external programs. You should be able to move, copy, archive to floppy, and delete faxes from within the program's transaction log. You may need to rotate pages transmitted upside down.

Printing assesses the degree and variety of output devices supported by the fax package. For example, you should be able to print selectively all or portions of a document. You should be able to print draft copies of documents, rotate pages, fit the output to a page, print multiple pages on one sheet, and annotate documents with headers and footers.

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PC Magazine, February 11, 1992

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CIRCLE 140 ON READER SERVICE CARD

dwindling cost of fax modems is rapidly shifting manufacturers to one of the two-way standards. All the software reviewed here will handle either the CAS or Class 1 standard. A number of the modems also claim Class 2 compatibility.

In this article, we look at the state of the art of computer faxing and review fax software and fax modems. As usual, we insisted that the products in this roundup be shipping at the time of the review.

Software products that couldn't meet our deadline included BitFax for DOS, Phoenix Fax, UltraFAX, Delrina Technology's WinFax PRO 3.0, and FaxTools from Microlytics. (See the sidebar "A New Generation in the Wings.") On the hardware side, the KeepInTouch Card, AT&T's credit-card size PCMCIA modem, which has 14,400-bps fax and data transmission, was in beta when we began testing. Other products that weren't ready for review include the BocaModem M1440E and the Macronix MX.

FAX-INATING SOFTWARE

Much of the software we reviewed still isn't smart enough to ferret out your fax modem and figure out which of several types you're using. Usually, setting up software means answering questions about the type of fax modem you have.

The fax software products we liked best ran under Microsoft Windows. One reason is that they were a lot simpler to set up and run. The Windows fax programs show up as printer options in your applications. Instead of printing to your HP or PostScript printer, you pick the fax option and tell your application to print. A window then pops up and asks you to list the name and phone number of the recipient of the fax or to pick a name from an existing phone book.

Another reason we like sending faxes

Our Contributors: JOEL DREYFUSS is the editor of *PC Magazine*. ALFRED POOR and M. DAVID STONE are contributing editors to *PC Magazine*. ROBERT KENDALL is a free-lance writer and a frequent contributor to *PC Magazine*. EDWARD J. BENACK is a staff manager at the Computer Technology Learning Center of New York Telephone. DAVID MORLITZ is a contributor to *PC Magazine*.

PC MAGAZINE

EDITORS' CHOICE

- **Eclipse FAX**
- **FaxMaster**

We selected two Editors' Choices: Eclipse Systems' Eclipse FAX and Caere Corp.'s FaxMaster. These are two excellent packages that perfectly illustrate the strengths of today's fax packages, and some of the underlying weaknesses.

Eclipse FAX is a thoughtfully crafted package, particularly strong in the newly emerging area of fax management. The indexing feature makes it wonderfully simple for users to store, group, and locate faxes. Thumbnail views of faxed pages and the option to store received faxes in Group 4 compressed format only add to Eclipse FAX's management capabilities. In addition, the program offers scanner support and a reasonably full-fledged graphics editor for creating and modifying cover sheets and for creating, modifying, or annotating faxes.

Eclipse FAX faxes from your applications and sends and receives in the background. The latter is virtually transparent to the user during foreground operations. This, of course, is attributable to its use of CAS modem control, which brings us to a weakness in Eclipse FAX: the lack of support for the Class 1 standard. The hardware of the vast majority of existing fax modems supports Class 1, but not CAS. Eclipse Systems has promised a new version of the product with Class 1 support (and OCR) to be released by the time this is in print.

Current owners of Class 1 hardware can certainly turn to another Microsoft Windows package, Caere's FaxMaster, for solid send/receive capability—and much more. While FaxMaster's background receiving (under Class 1) is not as smooth as Eclipse FAX's (under CAS) and its fax management capabilities are comparatively primitive, it shines in other areas. One of these is the FaxMaster entry in the File menu, which saves users the trouble of having to change printer drivers every time they send a fax. More impressive is FaxMaster's optical character recognition of incoming faxes. With OCR, you can now edit the messages you receive and store them as text rather than images (in one-tenth the disk space). While FaxMaster is not the only OCR-capable package we reviewed, it is the best, in terms of both recognition accuracy and the proofing tools provided to support the recognition process. A double click on a recognized section of a document reveals a quick look at the original bitmap, which helps verify accuracy. A proprietary compression technology significantly reduces the size of stored fax images.

Fortunately, there are capable choices in the DOS realm too—DosFax PRO and MTEZ Standard with ExpressFax. Neither qualified for Editors' Choice. But MTEZ deserves an honorable mention for its simple, easy-to-use design and unobtrusive background operation. DosFax PRO, though suffering from a two-step fax preparation procedure in which both print capture and send must be manually activated, is clearly ahead of the pack in certain areas. It excels at group sends, can load into high memory, has robust notification alarms, supports PCL 4, and can store faxes in both .PCX and TIFF formats. Coupled with Delrina Technology's WinFax PRO, DosFax PRO makes even more sense. The packages share faxes, as well as a good bit of organizational detail and functionality.

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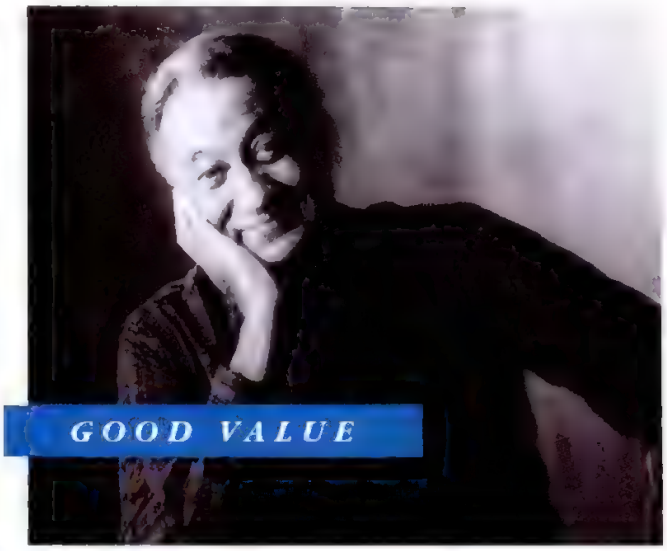
I remember
my first
one..."

"Now I Know Better."

"My first modem? Slow going, I gotta admit. *At 2,400 bps, it took forever. But the DataPort 14.4/Fax Modem knows amazing techniques and gets my data speeding up to 57,600 bps."*



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- Connects remote offices and homes to corporate headquarters, and
- Transfers data files; exchanges images with fax machines; accesses E-mail, bulletin boards, information services.

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- Comes ready to use, easy to operate
- Saves time waiting in line to send faxes
- Allows you to send presentation-quality faxes, and
- Receives faxes even if you've been working on your PC!

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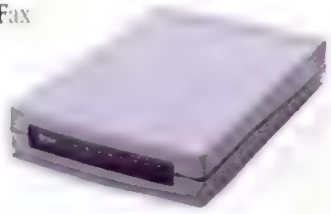

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through Windows is that they make use of the Adobe and TrueType fonts you have available. This means that your faxes can go out as fancy documents with a variety of typefaces and type sizes and in several graphic formats. But a number of the software packages we tested in both DOS and Windows did not handle gray-scale images well, turning sharp graphics into muddy blurs.

Most of the DOS programs we tested simply couldn't match the features available in Windows. Many, for example, limited their fax output to plain dot-matrix Epson type. One exception was Faxit for DOS, which supports PCL 5, Hewlett-Packard Co.'s printer command language for the LaserJet III. Most of the DOS packages could send ASCII text reasonably well, but they had trouble with clean transmissions of graphics files. While SofNet's Faxit for Windows transmitted gray-scale images, Faxit for DOS could only send black-and-white .PCX files.

In both DOS and Windows programs, the fax transmitted by a PC is usually sharper and clearer than one from a fax machine because the original image is digitized and not scanned. And both DOS and Windows programs offer the ability to save a fax to a file and transmit it later when phone rates are cheaper or fax machines are less busy.

The DOS programs require one or more TSRs to be loaded to function. For example, MTEZ Standard with ExpressFax, recently acquired by WordPerfect Corp., and Delrina's DosFax PRO both use a TSR to intercept files going to the printer. In the case of DosFax PRO, a second TSR monitors incoming calls. In tandem, the TSRs eat up more than 80K of memory before you load an application. Fortunately, DosFax PRO's drivers will load high with a memory manager to free up conventional DOS memory.

Receiving a fax should be transparent. Most of these packages give you a number of choices for reception and notification. You can pick the number of rings before the fax modem responds—important if you use the same line for voice or computer use. Some of the modems, like the Intel SatisFAXtion line, can differentiate between voice, fax, or data calls and direct them to the right device.

You can configure most software to beep or pop up a window after a fax arrives. Some programs will send faxes directly to the printer or simply save the files for you to read later. All let you view the fax, either as a thumbnail or full-size, to decide whether you want a printout.

THE ART OF MANAGEMENT

If you receive more than a few faxes a month, fax management quickly becomes a concern. Faxes are graphical images, so they take up a lot of disk space. A page of plain text can take up 80K; a page with a lot of graphics can approach 200K. Fax software should help you move, copy, compress, print, and delete faxes once you're done with them. Eclipse FAX, one of our two software Editors' Choices, was the strongest fax manager we saw.

For many corporate computer users, the ability to send and receive faxes at their desks means time saved.

The tool that promises to give the greatest advantage to computer faxing is OCR (optical character recognition)—the ability to convert an incoming fax into a text file that can then be edited or inserted into another document. Faxes post an interesting challenge to OCR software because a standard fax transmission skips every other line of a document. This means the OCR software has to decipher characters from just half the data available in a normal document.

While companies such as Caere Corp., makers of FaxMaster, claim their products use neural networks to "learn" characters, we find this technology adequate only if the incoming fax is transmitted in "fine" mode, which is often twice as slow as standard mode. Once OCR technology matures, the benefits of not having to retype or scan in an incoming fax could make computer faxing preferable to the regular fax machine.

Fax software is still in evolution. Delrina's next version of WinFax PRO will use the company's well-known forms technology and let you annotate faxes without printing them. UltraFAX will let you clean up transmission noise—those smudge marks you often see around the edges of your incoming fax. Xerox Corp.'s PaperWorks will continue to expand on its unique ability to fax work with smartly encoded paper forms. Scanner support, now found in a few products like Eclipse FAX and FaxMaster, will become commonplace.

THE HARD FAX

Most fax modems are built using fax and data pumps from a handful of manufacturers: AT&T, Intel, Phylon, Rockwell, and Sierra. But the OEMs argue that they customize the chips considerably. The wide range of performances on our tests indicate that they are right.

We tested 12 modems that met our criteria of Group 3 fax compatibility and V.42 and V.42bis (9,600 bps or higher) data transmission capability. We sent our test document over a simulated long-distance line. We tried to transmit a five-page Microsoft Word for Windows document and a one-page .PCX graphics file using an established fax program, Delrina's WinFax PRO 2.0. The Intel SatisFAXtion Modem 400/e turned in the shortest billing time on the fax document tests: 5 minutes 23 seconds. Some modems required several tries before they would stay connected. Four of them would not work at all with WinFax PRO.

These problems are a reminder that despite the established CAS and Class 1 standards, PC-based faxing is still an immature technology. Manufacturers are constantly updating ROM chips and software and suggesting new modem initialization strings. If your fax modem won't work with your favorite software, check with the makers of both; they may have worked out a solution.

Fortunately, fax modems are usually shipped with software. All the modems that failed to complete our tests with WinFax PRO were able to send a text file with their bundled software. The modems that used DOS software had more trouble with our test graphics files. In informal tests, some shrank the graphics files or distorted them. If you're going to transmit both text and graphics, you'll probably want to dump your bundled software for one of the full-featured programs we've reviewed.

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BitFax/OCR for Windows

BY M. DAVID STONE

With its eight colorful, labeled pictures on buttons (far too detailed to call icons), BitFax/OCR for Windows may well have the best-looking opening menu you've ever seen. But while this $199 program from BIT Software does its basic job of sending and receiving faxes well—and even comes with a Windows communications program to sweeten the deal—it fails to follow many Windows conventions and may frustrate users. (For details on the OCR side of this package, read the sidebar "Fax Plus OCR: A New Challenge." Also note that BIT Software says the $79 BitFax for Windows is essentially identical to the product reviewed here except for the lack of OCR features.)

The trouble with BitFax lies in little things. Take installation, for example. When you run the install program, you must either click on the Install button or hit the space bar to get past the first screen. Typical keyboard users may find themselves hitting Enter several times before realizing it won't work.

The rest of the installation runs smoothly enough; BitFax lets you designate program directories before copying the files and takes you through four setup screens afterwards. These screens prompt you for information (such as name and fax number) and let you enter up to eight phone numbers in a quick-dial directory and set receive and transmit options (such as COM port and speed). Note that the program's maximum fax speed is 9,600 bits per second; others, like Eclipse FAX, can go to 14,400 bps.

USING IT A BIT

As with most other Windows-based fax programs, BitFax installs as a Windows print driver. When you print to the driver, the DialFax screen comes up so you can pick fax recipients from either a quick-dial list or a phone book.

You can create only one phone book, but there is no limit on the number of entries. You can also assign phone-book entries to as many as 20 groups. Alas, the groups cannot be named; each is assigned an arbitrary number from 1 to 20, which makes it difficult to identify your groups.

Among the choices in the DialFax screen are options to add a cover page, print to a fax file, and add attachments (fax-format files only). You can also define a cover page by designating a logo file (in .BMP format) and typing in a text box on the cover-page screen. In addition to printing to the fax driver, you can call up the DialFax screen directly and send a file you had printed to disk or send a note as part of a cover page.

BitFax/OCR for Windows' main screen, shown here over the viewer, consists of detailed pictures to represent each of the main menu choices. The viewer toolbar, under the menu bar, includes options for zooming, rotating, and paging forward or backward through the file.

SUITABILITY TO TASK

BitFax/OCR for Windows

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	●	○
Receiving	●	●	○	○
Fax management	●	○	○	○
Printing	●	○	○	○

Sending and receiving are handled in the background, but both affect foreground operations. If you are typing text, for example, you will notice pauses in screen updates, with the screen catching up in bursts. The effect is mild enough, however, that you can continue working.

BitFax/OCR for Windows does its basic job well, but it often fails to follow many Windows conventions and may frustrate users.

You view received faxes by selecting an entry in the receive log and choosing View. The viewer offers five levels of zoom and the ability to rotate pages. You can also print from the viewer and retransmit the fax. There is no way to edit received faxes within the program.

FACT FILE

BitFax/OCR for Windows, Version 2.0

BIT Software Inc., 47987 Fremont Blvd., Fremont, CA 94538; 510-490-2928; fax, 510-490-9490

List price: $199

Requires: 4MB RAM, 5MB hard disk space, DOS 3.0 or later, Microsoft Windows 3.0 or later (386 Enhanced mode for OCR features)

In short: BitFax/OCR for Windows succeeds in sending and receiving faxes fairly unobtrusively in the background. But it offers little beyond the basics and fails to follow some Windows conventions

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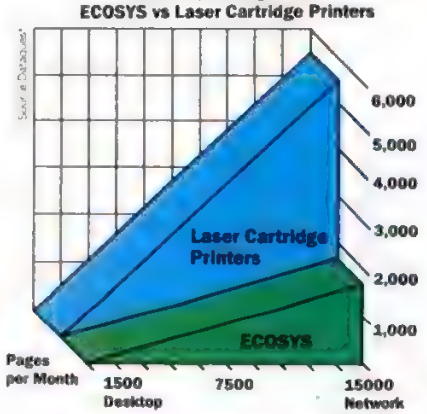

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Fax Plus OCR: *A New Challenge*

by Robert Kendall

Combining OCR with fax technology makes sense. Once you've converted a fax document into characters, you can load it into a word processor, database, or spreadsheet.

At review time, two of the fax packages covered in our fax software reviews—Caere Corp.'s FaxMaster and BIT Software's BitFax/OCR for Windows—offer built-in OCR, while Intel Corp.'s FAXability Plus also comes in an OCR version. A fourth package—Calera Recognition Systems' FAXGrabber—functions as an add-on to fax software.

FAXability Plus/OCR and FAXGrabber both incorporate Calera's OCR engine, which uses the feature extraction technology that has become the standard for OCR. Though not specifically designed to handle fax characters, it is optimized for any sort of document that is degraded in quality. The other two fax packages contain an OCR engine recently developed by Caere. Based on a neural network model and dubbed AnyFax, it's the first OCR engine designed from the ground up to handle the recognition problems unique to fax documents.

IN THE DISTANCE

Fax/OCR combinations were forthcoming at review time from Delrina Technology, Eclipse Systems, Phoenix Software, SofNet, and ZSoft. Delrina and Phoenix will incorporate the Caere and Calera OCR engines, respectively, while SofNet and ZSoft will rely on engines from ExperVision and Ocron. No information on Eclipse FAX's OCR engine was available at press time.

None of the packages we look at here can render documents received from a fax machine with the near–100 percent accuracy rates now common with standalone OCR packages working on scanned pages. Yet all are capable of delivering usable output from the 200- by 200-dot-per-inch files created by fine-mode fax transmissions.

With common fonts in the 10- to 12-point size range and a good-quality original, the accuracy rates of all these packages usually fluctuate from 97 to 99 percent—that is, 1 to 3 mistakes every 100 words. FAXability Plus/OCR and FaxMaster are more consistently accurate than the others, but no package is a clear winner. All these packages usually fail to produce usable output from normal-mode transmissions.

FAXMASTER

Caere's OmniPage Professional walked away from our last roundup of standalone OCR packages ("From Print to PC: OCR Gets You from There to Here," July 1992) with an Editors' Choice. So it is not surprising that Caere's $249 FaxMaster should sport the most well rounded OCR capabilities of these packages.

FaxMaster's superior interface really sets it above the rest. It's the only program that lets you proof a converted document without calling up a separate text editor.

FaxMaster is also the only program that offers spell-checking—a feature that's especially important when working with error-prone fax documents. When you view a text file, words corrected or not found in the dictionary appear in different colors. To check a word against the original document, you just double-click on it to pop up the corresponding portion of the graphics file. A search-and-replace function further facilitates proofing, helping you quickly locate the tildes that represent unreadable characters.

Once you have corrected your text, you can export it as an ASCII or .RTF file. If you want to bring files into other applications, you can install macros for several Microsoft Windows programs. These let you launch FaxMaster from within the other application and then paste a fax page into an open document, keeping formatting intact. FaxMaster supports fewer text formats than its competitors, however.

FaxMaster will automatically decompose text (deciphering column layouts and removing graphics), though you can turn this feature off to preserve the column layout of tables. It is the only program that lets you manually decompose a page by drawing boxes around portions of the text and numbering them to indicate order. This lets you tackle complex layouts beyond the reach of FaxMaster's competitors.

The program takes a rather crude approach to handling document orientation. If a document is in landscape format, you must call up the graphics file and rotate it before performing OCR. It is also the only program that lacks an option for coping with originals from a dot matrix printer.

FaxMaster has a number of options for automating OCR. You can configure the program to convert every fax as it comes in and optionally save each converted document as an ASCII file.

Since FaxMaster does a spell-check and requires an extra step to save text in ASCII format, it takes longer to process a document than the other programs discussed here. But more important, its proofing features should ultimately give you more accurate results. This is the only program considered here that offers the full functionality of a standalone OCR package.

BITFAX/OCR FOR WINDOWS

BIT Software's $199 BitFax/OCR for Windows incorporates the same OCR engine as FaxMaster, but without FaxMaster's spell-checking, proofing, or manual decomposition features. On the positive side, this streamlined implementation made BitFax the fastest performer in converting a simple page.

BitFax can automatically perform OCR on every fax as it comes in or manually convert them one at a time. During conversion, the program shows its progress by gradually shading an image of the fax page. There's also an option for automatically launching an application and loading the text file into it as soon as conversion is complete.

The program can't determine a document's orientation, but it will auto-

matically detect column layouts. You can also specify the number of columns for greater accuracy. BitFax is the only program reviewed here that supports foreign languages.

BitFax will export a wider range of text formats than FaxMaster. You can save documents not only in ASCII, tab-delimited ASCII, and a broad range of word processor formats, but also as dBASE files or Excel spreadsheets. A table format-conversion option will preserve column layouts in the file format you specify.

FAXABILITY PLUS/OCR

Intel's $249 FAXability Plus/OCR uses Calera's OCR engine. Intel has added a preprocessing feature that smooths out the characters in the graphics image. This feature gives the product a slight but noticeable edge in accuracy over Calera's FAXGrabber, making it a more reliable fax software package.

This program won't automatically perform OCR on every incoming fax. You can queue several faxes for conversion, though, and icons will show the status of each.

FAXability Plus/OCR will automatically handle all decomposition tasks and, unlike some competitors, will automatically determine the orientation of a fax page. The program's biggest OCR strength is the wealth of text formats it supports. It will convert documents to ASCII files, many word processor formats, and both Excel and Lotus 1-2-3 spreadsheets.

Where appropriate, FAXability Plus/OCR attempts to preserve the font sizes and attributes of the original document, as well as indents, justifications, and soft hyphens. As with other fax programs, however, this is not a very accurate process. When converting tables, it puts text into separate cells or separates it with tabs.

FAXGRABBER

Calera's $149 FAXGrabber was the first OCR product on the market intended specifically for fax documents. It uses the same OCR engine found in the vendor's Editors' Choice–winning (July 1992) standalone OCR software, WordScan.

Unlike the other products reviewed here, FAXGrabber has no communications capability of its own, but rather is designed to work in conjunction with third-party fax software. The program runs only as an icon and performs most of its functions automatically, though you can click or double-click on it to call up dialog boxes.

FAXGrabber will work directly with CAS software, SofNet's Faxit for DOS and Faxit for Windows, or Delrina's WinFax PRO, and the vendor promises support for additional programs. FAXGrabber checks the directory where these programs store received faxes in their proprietary format every 16 seconds. It automatically converts any new documents it finds there to .PCX format and performs OCR on them, or you can have the program wait for a command from you before it converts new documents.

With fax packages not directly supported, you can have FAXGrabber monitor a directory and convert .DCX (multipage .PCX), .PCX, or TIFF files as soon as they appear there. Unfortunately, you'll have to start by saving files in one of these formats.

FAXGrabber will automatically detect the orientation of documents it recognizes, though you can also specify this manually to speed up processing. It auto-detects the number of columns on a page for decomposition, though you can override this to preserve table layouts. FAXGrabber will save text as ASCII files, in many word processor formats, or as Excel or Lotus spreadsheets. □

FAXability Plus/OCR, Version 1.0 *Intel Corp., C03-11, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124-6497; 800-538-3373, 503-629-7354; fax, 800-525-3019. List price: $249.*
Circle 483 on reader service card

FAXGrabber, Version 1.01 *Calera Recognition Systems Inc., 475 Potrero Ave., Sunnyvale, CA 94806; 800-544-7051, 408-720-8300; fax, 408-720-1330. List price: $149.*
Circle 484 on reader service card

Fax management features are limited to deleting fax files and archiving them to other disks. Notably absent from the program is context-sensitive help for many of the key screens. And among the small frustrations, the program ignores the convention of using the Esc key as the equivalent of the cancel button.

If you are willing to accept these oversights, and you expect that your fax management will consist mainly of deleting faxes after you've printed or read them, you'll find that BitFax/OCR does its basic job well enough to justify the price.

Delrina Technology Inc.

DosFax PRO

BY M. DAVID STONE

Delrina Technology is well known for its Windows fax program, WinFax PRO (for a preview of WinFax PRO, Version 3.0, read the sidebar "A New Generation in the Wings"). But the company hasn't forgotten about DOS. The $79 DosFax PRO, Version 2.0, provides a full-function DOS-based fax program. And for those who use both environments, DosFax provides a DOS-based partner to

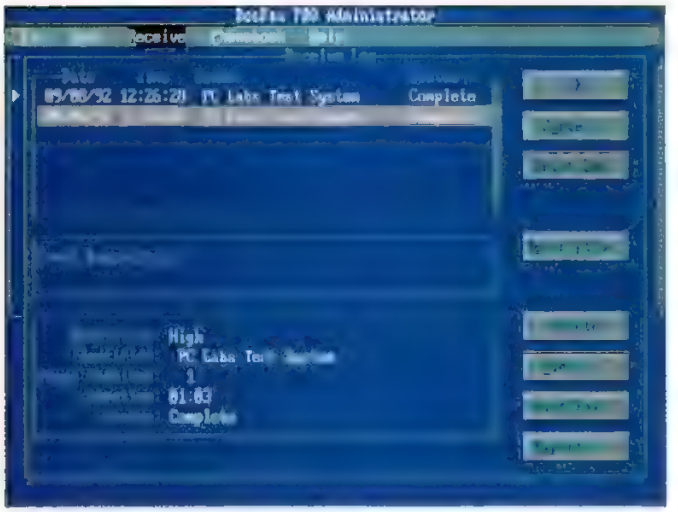
WinFax 2.0. (A Delrina representative reports that DosFax 3.0, which at press time didn't have a promised release date, will likewise provide file compatibility and function compatibility with WinFax 3.0.)

DosFax 2.0 can share fax logs, phone books, and fax image files with WinFax 2.0. Even better, the background module is designed to gracefully hand over fax control when you load WinFax and take control back when you return to DOS. If you get both programs, you wind up with a seamless fax system for DOS and

SUITABILITY TO TASK

DosFax PRO

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	●	○
Receiving	●	●	●	○
Fax management	●	○	○	○
Printing	●	●	○	○



DosFax PRO offers a Microsoft Windows–like interface, with pull-down menus, dialog boxes, and so on. Shown here is the Receive Log dialog box, with the main screen's menu bar showing across the top.

Windows. The DOS interface even offers a Windows-like look and feel.

Installation is straightforward, and the program supports Class 1, Class 2, and Send-fax standards, as well as the U.S. Robotics WorldPort Palmtop modem.

FAXOLOGY

Unlike most fax packages, DosFax will not fax ASCII or other standard files directly from disk. Rather, data must first be translated to fax format by printing from a program, capturing the print stream, and translating the data to fax format. You can set the TSR translation program for either an HP (PCL 4) or Epson FX driver.

FACT FILE

DosFax PRO, Version 2.0

Delrina Technology Inc., 6830 Via Del Oro, #240, San Jose, CA 95119-1353; 800-268-6082, 408-363-2345; fax, 408-363-2340

List price: $79

Requires: 640K RAM, 2MB hard disk space, DOS 3.1 or later

In short: Delrina Technology's DosFax PRO can share files with WinFax PRO, Version 2.0. For dedicated DOS users, this program offers unobtrusive background operations and the ability to capture Epson and HP print output from DOS programs and translate the output to a fax

400 ON READER SERVICE CARD

DosFax actually uses two TSRs: one for background fax operations and one for capturing data, translating it, and designating a recipient, cover letter, and time to send. Unless told to do otherwise, the installation program modifies your AUTOEXEC.BAT to load both modules each time you boot. In tandem, these two TSRs will eat up 82K of conventional RAM, but they can exist very comfortably in high memory.

To send a fax, you use a hotkey to capture what you want to send, then print from your application with the appropriate print driver. After printing, another hotkey calls up the Fax Send screen so you can designate a recipient and time to send, add a cover page, and so on. Alternatively, you can save the translated data to a file and send it later. This is particularly useful if you need to send several files to the same recipient. You can save each file to disk and then send all the files at once.

The phone book feature allows an ample 1,000 entries per phone book, with no limit on the number of phone book files. You can't designate multiple phone book entries as recipients for a given fax; you can, however, easily assign entries to one or more permanent groups. The phone book can also import ASCII files.

SEE IT COMING

To see incoming faxes, you load the DosFax Administrator—a foreground program that also lets you send faxes, change most setup options, and access the phone book. You can also select from a rich variety of notification alarms. There is no graphics editor, though you can view faxes on-screen as well as print them. The program lists about 130 printers that it supports, including PostScript choices. There is no OCR or scanner support, and little fax management capability.

Note that although DosFax will necessarily tie up your system when printing from an application, the actual sending and receiving of faxes takes place in the background. If you are working in the foreground, you will notice hardly any effect.

DosFax is the obvious choice—along with WinFax—for those who spend significant amounts of time in both DOS and Windows. But even if you don't spend any time in Windows, DosFax's print capture approach and unobtrusive background operation make it a good choice for faxing in DOS.

Users can select from DosFax PRO's rich variety of notification alarms.

Eclipse Systems Inc.

Eclipse FAX

BY M. DAVID STONE

Sporting a name that is far more appropriate than probably intended, Eclipse FAX, from Eclipse Systems, has until now been largely eclipsed by better known but lesser programs. But that may change with time: The program was only just released this past April. Still in version 1.1, this $119 Windows program doesn't currently offer the OCR capabilities that you'll find in the newest crop of fax programs. But it offers far more than most of the competition, including scanner support, a built-in graphics editor, and strong fax management features.

The biggest oversight in Eclipse FAX

SUITABILITY TO TASK

Eclipse FAX

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	●	○
Receiving	●	●	●	●
Fax management	●	●	●	●
Printing	●	●	●	○

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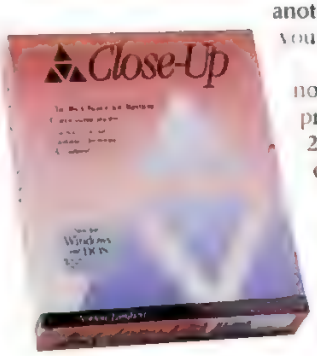

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- Dual floppy drive
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Upgradable to 425SX, 440DLC, 433DX, 450DX2, 466DX2

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- Local bus video
- Dual floppy drive
- FREE MS DOS 5.0, Windows 3.1, serial mouse

Upgradable to 433DLC, 425SX, 440DLC, 433DX, 450DX2, 466DX2

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Lease for only $55/mo.
Full profile also available

Express Scalable 450DX2

- i486DX2 processor rated at 50MHz
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- 170MB hard drive
- 14" non-interlaced 72Hz HRVGA (1MB memory)
- Local bus video
- Dual floppy drive
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Upgradable to 466DX2

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Lease for only $79/mo.
Full profile also available

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- Built-in mouse trackball
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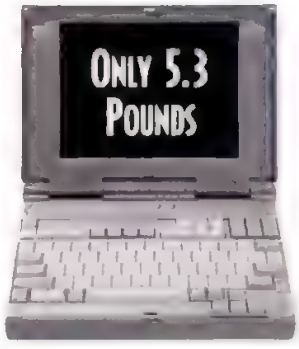

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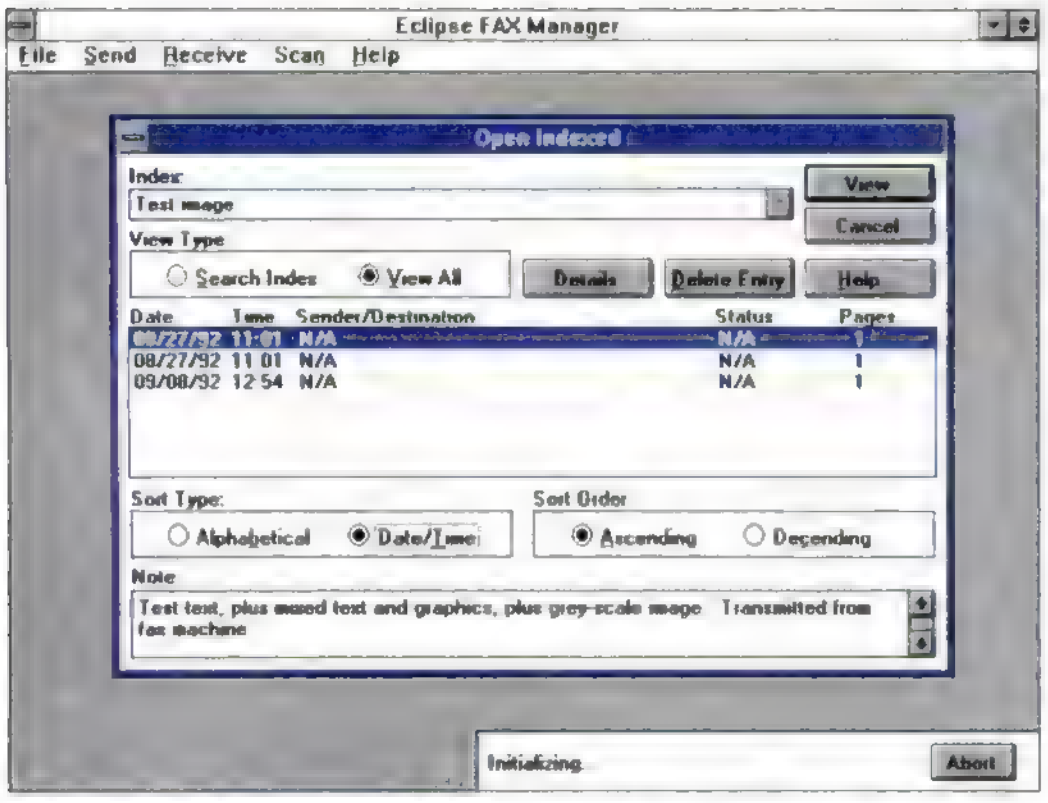

Eclipse FAX is strong on fax management features.

The Open Indexed dialog box, shown here, will let you find files—once you've indexed them—by looking for the index entry. Notice that in addition to the index entry, you can enter a note to further describe each file.

is the lack of Class 1 support. The program can handle CAS and Class 2 fax modems, however. And Eclipse Systems expects to add Class 1 (and OCR support) by the time this is published.

EASY BASICS

Using the program can be almost as easy as installing it (and installation couldn't be simpler)—as long as you stay with the basic features. You simply set Eclipse FAX as your Windows printer, then print from any program. Eclipse FAX pops up its Send Fax dialog box so you can enter a recipient's name and fax number. After typing in the name, you can add it to the phone book. You can also pick names from the phone book or create a group list on the spot.

Other choices in the Send Fax dialog box let you add a cover sheet (you can use one of the sample sheets that comes with the program if you haven't created your own), designate a time to send, and give the command to send the fax or send the output to a file.

If you load the Eclipse FAX Manager, using the program can seem far more complicated, but only because the program has so many features. You can, for example, simply open a file, or you can open a file based on an index—if you previously saved the file with an index entry.

Indexing your faxes (both incoming and outgoing) makes fax management much easier. Indexing involves giving each file a meaningful name or description as an index entry—much like an index entry in a book index. The entry can be more than 50 characters long. In addition, you can add a note (up to several lines long) as a secondary and more detailed identification. The secondary identification becomes particularly important if you give more than one file the same index entry (as with a project name, for example.)

The index feature is designed for maximum flexibility. For example, it will let you index files in any disk or directory on your system, so you can keep files anywhere you like and break them into whatever groups seem appropriate. On the other hand, the indexing makes it easier to keep track of more files in a single directory, so you can conveniently keep all your files in one directory if you like.

When searching through the index, you can sort the file list either alphabetically or by date and time, as appropriate. Similarly, you can choose to view a list of all files or list only those files that share the currently highlighted index entry, as appropriate. Whichever the choice, as you move the highlight through the list the dialog box will show you the index entry, note, and file details for each file.

GRAPHIC ANNOTATIONS

Eclipse FAX offers a capable graphics editor as part of its viewer. Use it to create or modify cover sheets and to create, edit, or annotate faxes. You'll find a text tool and tools for drawing lines, ellipses, and rectangles. The viewer also has tools for moving among pages, rotating pages, and seeing a fax in thumbnail view.

Background sending and receiving has an appropriately minor effect on foreground operations. If you're typing text, for example, you'll hardly notice anything happening. When you send a file, however, the processing before sending is quite noticeable.

Because there is so much to the program, expect it to take you a while to learn Eclipse FAX; if you need only minimal fax capability, you may find more here than you want. But if minimal features are not enough—and particularly if you want a Windows program that is strong on fax management—Eclipse FAX is one of the strongest choices.

PC EDITORS' CHOICE

FACT FILE

Eclipse FAX, Version 1.1

Eclipse Systems Inc., 33 W. Monroe St., #1121, Chicago, IL 60603; 800-452-0120, 312-541-0260; fax, 312-541-0514

List price: $119.

Requires: 2MB RAM, 1.5MB hard disk space, DOS 3.0 or later, Microsoft Windows 3.0 or later

In short: Eclipse FAX offers a graphics editor, strong fax management features, and the common Windows convenience of sending faxes by printing to the fax driver.

481 ON READER SERVICE CARD

Intel Corp.

FAXability Plus

BY ALFRED POOR

Intel is recognized as a chip maker with lots of experience in the fax hardware business. So it stands to reason that the company's experience would lay a firm foundation for its fax software product, the Windows-based FAXability Plus ($199). Well, despite its heritage, the package falls far short of the competition's. FAXability Plus is easy and pleasant enough to use, but it lacks some of the features necessary to be a top contender in this field. A $249 version of the product that includes OCR, FAXability Plus/OCR for Windows, uses Calera's OCR engine (refer to the sidebar Fax Plus OCR: A New Challenge).

FAXability Plus's main attraction is ease of use. If you can print a document through Windows, you can fax it with this program. Like other products reviewed here, you use the same Print command to fax as you do to print.

FAXability Plus supports Intel's and other vendors' Class 1 and Class 2 fax mo-

▶ SUMMARY OF FEATURES

Fax Software

Products listed and described in this chapter

■ = YES ☐ = NO

	BitFax/OCR for Windows	DosFax PRO	Eclipse FAX	FAXability Plus	Faxit for DOS	Faxit for Windows	FaxMaster
List price	$199.00	$79.00	$119.00	$119.00	$79.00	$99.00	$249.00
User Interface							
DOS or Windows	Windows	DOS	Windows	Windows	DOS	Windows	Windows
Mouse support	■	■	■	■	■	■	■
Toolbars	■	☐	■	■	☐	☐	■
Context-sensitive on-line help	☐	■	☐	☐	☐	☐	☐
Compatibility							
Fax transmission standards							
Group 3	■	■	■	■	■	■	■
Group 4	☐	☐	☐	☐	☐	☐	■
Advanced Group 3 features							
2-D encoding support	☐	☐	☐	■	☐	☐	■
Binary file–transfer support	☐	☐	☐	■	■	☐	☐
Error correcting mode (ECM)	☐	☐	☐	■	☐	☐	■
Modem control standards							
CAS	☐	☐	■	■	■	■	■
Class 1	■	■	☐	■	■	■	■
Class 2	■	■	■	■	■	■	■
FaxBIOS	☐	☐	☐	☐	☐	☐	☐
Send fax	■	■	☐	■	■	■	■
Supported transmission speeds							
2,400 bps	■	■	■	■	■	■	■
4,800 bps	■	■	■	■	■	■	■
7,200 bps	■	■	■	■	■	■	■
9,600 bps	■	■	■	■	■	■	■
12,000 bps	☐	■	■	■	■	■	■
14,400 bps	☐	■	■	■	■	■	■
Composing							
Includes text editor	☐	■	■	■	■	☐	■
Accesses another text editor	☐	☐	☐	☐	☐	☐	■
Composes cover page	■	■	■	■	■	■	■
Full page	■	■	■	■	■	■	■
Half page	■	■	■	☐	☐	☐	■
Supports bitmapped graphics	■	■	■	■	■	☐	■
Signature	☐	☐	■	☐	☐	N/A*	☐
Logo or letterhead	■	■	■	■	■	N/A*	■
Allows distinctive second sheet	■	☐	■	☐	☐	☐	☐
Sending							
User can fax directly from application	■	■	■	■	☐	■	■
Prints to fax software as a print driver	■	☐	■	■	☐	■	■
Intercepts printer data stream and converts it to fax format	N/A**	■	N/A**	N/A**	■	N/A**	N/A**
Sends screen capture	☐	☐	☐	☐	☐	☐	☐
Sends selected portion of document	■	☐	■	■	☐	■	■
Allows preview before sending	☐	☐	■	☐	☐	☐	■
Sends faxes in the background	■	■	■	■	■	■	■
Sends faxes at user-specified time	■	■	■	■	■	■	■
User can send to multiple recipients	■	■	■	■	■	■	■
User can poll remote fax machines	☐	☐	☐	☐	☐	☐	☐
Phone Books							
Maximum number of phone books	1	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	1
Maximum entries per phone book	Unlimited	1,000	16,000	999	50	Unlimited	65,000

N/A* Not applicable. Program does not support this feature. N/A** Not applicable. Program does not intercept printer data stream.

	FaxTalk Plus	The Fax Window	Mirror III Fax	MTEZ Standard with ExpressFax	PaperWorks	SuperFax for Windows
	$69.00	$119.00	$249.00	$99.00	$249.95	$99.00
	Both	Windows	DOS	DOS	Windows	Windows
	☐	■	■	■	■	■
	☐	☐	■	☐	■	■
	■	☐	■	■	☐	■
	■	■	■	■	■	■
	☐	☐	☐	☐	☐	☐
	■	☐	☐	☐	■	☐
	■	☐	☐	☐	☐	☐
	■	■	☐	☐	☐	☐
	☐	☐	☐	☐	■	☐
	■	■	■	■	☐	■
	☐	■	☐	■	☐	■
	☐	☐	☐	☐	☐	☐
	☐	☐	■	☐	☐	☐
	■	■	☐	■	■	■
	■	■	☐	■	■	■
	■	■	☐	■	■	■
	■	■	■	■	■	■
	■	☐	☐	■	■	☐
	■	☐	■	■	■	☐
	☐	☐	■	■	☐	☐
	☐	☐	■	☐	☐	☐
	■	■	■	■	☐	■
	■	■	■	☐	☐	■
	■	N/A**	■	■	N/A**	N/A**
	■	☐	■	☐	☐	☐
	■	■	■	☐	☐	☐
	■	☐	■	■	☐	■
	■	■	■	■	■	■
	■	■	■	■	■	■
	■	☐	☐	☐	☐	☐
	1	1	Unlimited	1	1	1
	Unlimited	Unlimited	32,000	200	Unlimited	Unlimited

CONTINUES

dems, CAS-compatible fax devices, and fax modems based on the Send-fax (send only) chip set from other vendors. You run the installation program from within Windows, and if you have a CAS-compatible device installed (or compatibility software loaded) the install program will automatically identify your modem. If you are using a different modem, you will have to select it from an on-screen list.

FAXability Plus is easy and pleasant enough to use, but it lacks some of the features necessary to be a top contender in this field.

The install program also politely lets *you* designate the program manager group where you want the FAXability Plus icon to appear.

FAX-ABLE

Faxing with the package is as easy as selecting the FAXability Plus driver as your Windows printer and choosing Print from any application's File menu. If you use the program with a CAS-compatible device, you will hardly notice that a fax is being sent. In contrast, our tests with a Class 1 fax modem showed that sending

FACT FILE

FAXability Plus, Version 1.0

Intel Corp., CO3-11, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124-6497; 800-538-3373, 503-629-7354; fax, 800-525-3019

List price: $119

Requires: 2MB RAM, 2MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0 or later

In short: FAXability Plus has the ability to handle most send and receive fax functions under Windows, but it does not offer the depth and flexibility of some competing products

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SOFTWARE

We carry only the latest versions of products. Version numbers are current at press time. Products listed here in red are Microsoft Windows Applications.

Abracadata
5591 ◙Everybody's Planner 2.0 ... $49.
AddStor
4090 ◙SuperStor 2.0 ... 59.
Adobe Systems
7547 ◙Adobe Type Manager 2.0 for Windows 59.
6591 ☐Adobe Illustrator 4.0 for Windows ... 389.
5988 ☐Adobe Illustrator Competitive Upgrade 189.
7940 ☐Adobe Type Set Value Pack *(30 fonts)* 39.
(Entire Adobe Type Library available.)
Aldus
8000 ☐Persuasion 2.1 for Windows ... 329.
1332 ☐PageMaker 4.0 for Windows ... 499.
6223 ◙Gallery Effects 1.0 for Windows ... 139.
7540 ☐IntelliDraw 1.0 for Windows ... 199.
Alpha Software
9724 ☐Alpha FOUR 2.0 Competitive Upgrade 99.
5104 ◙Alpha FOUR 2.0 *(incl. Free 2 LAN Pack)* 329.
Altsys Corporation
8675 Fontographer for Windows *(3½" only)* .. 259.
Application Techniques
8337 ◙WinDings 1.0 for Windows ... 49.
1214 ◙Pizazz Plus 3.0 ... 79.
Approach Software
6598 ◙Approach 2.0 for Windows ... 259.
3830 ◙Approach 2.0 Competitive Upgrade ... 145.
Ares Software
6030 ◙FontMonger 1.1 for Windows ... 95.

Berkeley Systems
6649 *Star Trek: The Screen Saver*—Over 15 animated displays, password protection, & full compatibility with After Dark ..... **$34.**
9885 ◙ *After Dark 2.0 for Windows*—Saves screens w/over 40 incredible displays. Enjoy Flying Toasters & DOS blanking to black **29.**

Artisoft
2455 Lantastic AE-2 EtherNet Starter Kit 4.1 *(incl. software, 2 EtherNet cards, cable)*.. $479.
9775 Lantastic AE-2 Starter Kit for Windows 499.
2452 AE-2 EtherNet Adapter Card ... 199.
Asymetrix
1766 ◙MediaBlitz! 1.0 ... 69.
5771 Multimedia Tool Book 1.0 *(CD & 3.5")*.. 499.
Atech Software
4797 ◙AllType 2.0 *(universal typeface converter)* .. 45.
5708 ◙FastFonts DOS 57. 5718 Windows . 57.
Automap
2729 ◙Automap USA for DOS ... 55.
8569 ◙Automap USA for Windows ... 55.
6700 ◙Automap Europe ... 79.
Avery Dennison
6006 ◙Label Pro 1.6 *(Laser)* ... 49.
Banner Blue Software
3322 ◙Family Tree Maker 2.0 ... 39.
2088 ◙Org Plus 1.0 for Windows ... 125.
Berkeley Systems
9885 ◙After Dark 2.0 for Windows ... 29
6649 Star Trek: The Screen Saver *(3½" only)* 34.
Bitstream
Bitstream Li'l Bits *(3½" only)* ... *ea.* 19.
8040 ◙FaceLift 1.5 for WordPerfect 5.0/5.1 .... 69.
6066 ◙TrueType Font Pack 1 for Windows 3.1 52.
2089 ◙MakeUp 1.0 for Windows 3.0/3.1 ... 95.

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Winter Holiday Font Pack also available.

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9635 ◙Object Vision 2.1 ... 99
6242 ◙Quattro Pro 4.0 ... 319.
9695 ◙Borland C++ 3.1 ... 325.
1514 ☐Paradox 4.0 ... 529.
Broderbund
1434 ◙New Print Shop 3.0 ... 35.
5900 ◙PC USA 2.0 29. 5902 ◙PC Globe 5.0 39.
ButtonWare
6419 ◙PC-File 6.5 ... 85.
Caere
4130 ◙Faxmaster 1.0 ... 159.
6568 ◙Omnipage Direct 1.0 ... 259
8933 ◙Omnipage Professional 2.1 ... 629.
Calera
1769 ◙Fax Grabber 1.01 ... 99.
1953 ◙WordScan Plus 1.1 ... 429.
Central Point
5039 ☐PC Tools 8.0 ... 125.
9751 ◙AntiVirus 1.3 ... 89.
8114 ◙Backup 7.1 *(DOS and Windows)* ... 89
ChipSoft
1663 ◙Turbo Tax Personal 1040 for DOS ... 49.
3517 ◙Turbo Tax Personal 1040 for Windows ... 49
◙Turbo Tax State Packages for DOS .. *ea.* 39.
Clear Software
5987 ◙AllClear 1.2 ... 179.
CompuServe
7546 ◙DOS Membership Kit 2.0 ... 25.

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Computer Associates
5779 ACCPAC Simply Accounting 1.0 for Windows *(3½" only)* ... 119.
8530 CA-Textor 6.0 *(3½" only)* ... 85.
Concentric Data Systems
6575 ◙R & R Report Writer 5.0 ... 159.
Contact Software
1625 ◙Act! 2.1 ... 229.
Corel Systems
5506 ☐CorelDRAW! 3.0 ... 395.
4560 ☐CorelDRAW! 3 0 Competitive Upgrd. 225.
Data Storm
4798 ◙PROCOMM PLUS 2.01 ... 69.
6918 ◙PROCOMM PLUS 1.0 for Windows .... 99.
DCA/Crosstalk
5611 ◙Crosstalk 2.0 for Windows ... 119.
Delrina Technology
2446 ◙WinFaxPro 3.0 ... 79.
5974 ◙DOSFax PRO 2.0 ... 49.
7351 ☐PerForm PRO Plus 1.0 ... 239.
ExperVision
7494 ◙TypeReader 1.01 Windows *($100 rebate)* 479.
Fifth Generation Systems
7725 ◙Direct Access 5.1 ... 64.
3950 ◙Fastback Plus 119. 6431 ◙ Windows 119.
Frame Technology ... CP
6585 ☐FrameMaker 3.0 for Windows ... 525.
Gibson Research
9832 ◙SpinRite II 2.0 ... 59.
Harvard Associates
2324 ☐PC Logo 4.0 ... 59.
Hayes
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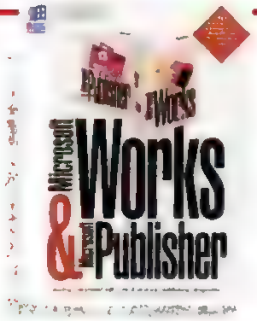

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6390 ☒ *Works for Windows & Publisher*—Two easy-to-use Windows applications, one great price. Works incl. spreadsheet, database, word processor, charting, & drawing. Publisher creates newsletters & flyers ..... **$195.**

Helix Software
9627 ☒Netroom 2.2 ..... 52.
Hewlett-Packard
8731 ☒Dashboard 1.0 for Windows *(while supplies last)* ..... 32.
8101 ☒NewWave 4.0 ..... 109.
IBM
2666 ☐DOS 5.0 Upgrade ..... 59.
7303 ☐OS/2 2.0 Upgrade from DOS ..... 99.
Inset Systems
7298 ☒HiJaak 2.1 139. 3820 ☒for Windows 139.
7300 ☒Inset Plus HiJaak ..... 165.
Intuit
2426 ☒Quicken 5.0 45. 5596 ☒for Windows . 45.
6158 ☒QuickBooks 1.0 ..... 89.
LaserTools
6882 ☒PrintCache 3.0 ..... 99.
0510 ☒PrimeType 1.0 for WordPerfect ..... 62.
Light Source
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Lotus
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1852 ☐1-2-3 2.4 Upgrade ..... 99.
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3424 ☐1-2-3 1.1 for Windows Upgrade ..... 99.

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5799 ☒Ami Pro 3.0 249. 1847 Comp. Upgrd. $95.
7812 ☒LotusWorks 3.0 ..... 95.
3523 ☐Freelance 1.0 for Windows ..... 349.
5981 ☐SmartSuite *(Ami Pro, Freelance, and 1-2-3 for Windows)* ..... 469.
2748 ☒cc:Mail Windows Platform Pack ..... 325.
MECA
2798 ☒Managing Your Money 9.0 ..... 45.
4603 ☒Tax Cut 1992 *(Headstart Edition)* ..... 45.
3885 ☒Tax Cut 1992 Windows *(Headstart)* .... 45.
Microcom
6234 ☒CarbonCopy Plus 6.1 129. 6958 Upgrd. 45.
4410 ☒CarbonCopy Plus 1.0 for Windows .... 129.
Micrografx
3627 ☐Windows Draw! 3.0 *(limited time)* ..... 99.
MicroLogic Software
8579 ☒MoreFonts 3.0 ..... 75.
5350 ☒TrueType 1.0 for DOS ..... 49.
Microsoft
3338 ☐Money 2.0 for Windows ..... 19.
7010 ☐Windows 3.1 ..... 89.
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6224 ☐Windows for Workgroups Upgrade ..... 89.
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1620 ☐MS-DOS 5 Upgrade ..... 59.
6188 ☐FoxPro 2.0 ..... 479.
1624 ☒Visual Basic 2.0 Standard Edition .....
MicroSpeed
8659 ☒Cursor Deluxe 1.0 ..... 27.
Nolo Press
2982 ☒WillMaker 4.0 ..... 35.
Norton-Lambert
2753 ☐Close-Up Dual Pack for Windows & DOS 129.

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PC-Kwik
8565 ☐WinMaster 1.0 ..... 65.
4925 ☐PC-Kwik Power Pak 3.0 w/Power Disk 79.
Peachtree
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3221 ☐Expanded Memory Mgr. 386 6.0 ..... 59.
6589 ☐DESQview/X 1.0 ..... 169.
QUE Software
3091 ☒RightWriter 5.0 for Windows ..... 49.
Reality Technologies
8564 ☐Smart Investor 1.0 ..... 59.
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7483 ☒Grammatik V for Windows ..... 55.
Shapeware
5426 ☒Visio 1.0 for Windows ..... 199.
Sitka
5450 10NET Two-User Network Pack ..... 129.
6440 10NET Expander Pack *(3 nodes)* ..... 189.
Software Publishing
3482 ☐Harvard Graphics 3.0 ..... 399.
4403 ☐Harvard Graphics 1.0 for Windows .... 369.
Stac Electronics
1409 ☒Stacker 2.0 ..... 95.
Stairway Software
6430 ☐Screen Extender 2.0 for WordPerfect 5.0/5.1 59.
Symantec
3784 ☐The Norton Backup 2.0 for Windows ... 99.
3146 ☐The Norton Utilities 6.0 ..... 115.
7999 ☐Norton Anti-Virus 2.0 ..... 84.
2359 ☐The Norton Desktop 2.0 for Windows 115.
8378 ☐Norton PC Anywhere 4.5 ..... 119.
SYSTAT, Inc.
1221 SYSTAT 5.0 for Windows *(3½" only)* ... 699.
3-D Visions
6210 ☒Stanford Graphics 2.0 for Windows ... 369.
Teleware
9847 ☒M.Y.O.B. 3.0 for Windows ..... 139.
Time Solutions
7295 ☒Med$ure 1.0 ..... 69.
TIMESLIPS
5696 ☒Timeslips Release 5 ..... 189.

PC CONNECTION®

For awarding us a

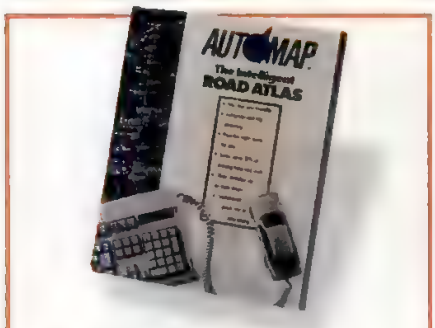
Shapeware

5426 ◙ *Visio 1.0 for Windows*—Drag. Drop. Done! Drawings practically draw themselves. With Visio's drag & drop drawing & more than 15 job-specific stencils, anyone can create professional-quality graphics **$199.**

Timeworks
6350 ◙ Publish it! for Windows ..... 82.
T/Maker
6027 □ Fax Mania DOS or 7911 Windows *ea.* 27.
Tool Technology
1561 WinDesk 1.0 for Windows *(3½" only)* .... 55.
3863 WinTools 1.0 for Windows *(3½" only)*.. 119.
Touchstone Software
7420 ◙ Check It Plus 3.0 ..... 85.
4112 ◙ CheckList 1.0 for DOS and Windows .. 72.
Traveling Software
4407 ◙ LapLink Pro 4.0 ..... 99.
WordPerfect Corporation
3804 ◙ WordPerfect 269. 3494 ◙ for Windows .279.
XTree
3328 □ XTree 1.0 for Windows ..... 65.
6161 ◙ XTree Gold 2.5 ..... 95.

RECREATIONAL/EDUCATIONAL

Abracadata
3629 ◙ Design Your Own Home-Architecture 3.6 32.
ActiVision
5401 ◙ Shanghai II ..... 29.
5400 ◙ Sargon V *(computer chess)*..... 29.
Buena Vista Software
8351 □ Heaven and Earth 1.0..... 29.
Broderbund ... CP
3340 ◙ Kid Pix 1.0 ..... 35.
5851 ◙ SimCity 1.0 from Maxis..... 29.
4411 ◙ SimEarth 1.0 for Windows from Maxis 45.
Davidson & Associates
3947 ◙ Math Blaster Plus ..... 29.



Automap

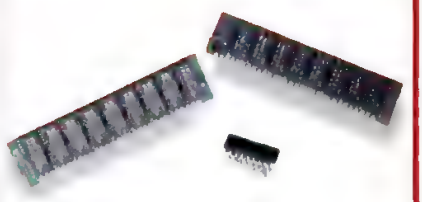
Automap USA—Intelligent PC road atlas! Provides hundreds of color maps, a large database of information, & prints detailed driving instructions. Great for vacation or business travel. 2729 ◙ *DOS* **$55.** 3569 ◙ *Windows* **$55.**

Electronic Arts
7525 ◙ PGA 1.0 for Windows ..... $39.
1811 □ Patriot 1.0 ..... 49.
Great Wave Software
8390 ◙ NumberMaze 1.0 - DOS ..... 25.
HyperGlot Software
(French, German, Italian, Spanish available.)
□ Word Torture for Windows..... *ea.* 34.
□ Word Torture 3.0 ..... *ea.* 29.
Interplay
8653 ◙ Mario Teaches Typing ..... 24.
4692 ◙ Dvorak on Typing for Windows..... 29.
4684 ◙ Dvorak Top 30 *(30 best shareware)*.... 35.
Knowledge Adventure
6456 □ Isaac Asimov's Science Adventure ..... 49.
3510 □ Space Adventure ..... 49.
Konami/Ultra Software
4909 □ Batman ..... 39.
5095 □ Teen. Mutant Ninja - Manhattan Mission 29.
Microsoft
5514 □ Entertainment Pack 4 ..... 29.
2858 □ Flight Simulator 4.0..... 39.
8492 □ Golf for Windows ..... 45.
Penton Overseas
◙ VocabuLearn/ce Levels I & II *(French, Italian, German, Spanish, Russian, Hebrew and Japanese)* ..... *ea.* 35.

TIMESLIPS

5698 ◙ *Timeslips Release 5*—See where your hours are going with Timeslips Release 5. Re-engineered for today's business & service professionals. New features including multiple billing rates & many new reports .... **$189.**

Personal Training Systems
Training tutorials-beg. to adv. for Windows, Excel, PageMaker, WordPerfect, Ami Pro, Microsoft Word & Lotus 1-2-3 *(3½")* *ea.* 49.
Sierra On-Line ... CP
8591 □ Quest for Glory III ..... 39.
5150 □ Aces of the Pacific ..... 45.
5338 □ King's Quest 6 ..... 45.
Software Marketing Corporation
5147 ◙ Orbits 1.0 ..... 39.
5145 ◙ Bodyworks 1.0 or 8531 ◙ Autoworks *ea.* 49.
Software Toolworks
4534 ◙ Mavis Beacon Teaches Typing 2.0 *(CP)* 29.
3023 ◙ ChessMaster 3000 29. 3032 Windows 35.
5032 Miracle Piano Teacher *(incl. kybd.)*..... 325.
Spectrum Holobyte
4833 ◙ Super Tetris 1.0 for Windows ..... 29.
8323 ◙ Tetris Classic ..... 29.
Strategic Studies Group
8444 □ Carriers at War..... 39.
Stone & Associates
5446 ◙ BookMaster for SpeedReading ..... 32.
5231 ◙ Talking Phonics Plus ..... 26.
Toyogo
5138 ◙ Go Master Deluxe 5.0 for Windows..... 99.
5143 ◙ Go Master Deluxe 5.0..... 99.
Walt Disney Computer Software
1162 ◙ Mickey & Friends Fun Pack 1.0..... 23.
2629 ◙ Mickey's 123's or 2624 ABC's..... *ea.* 29.
9984 ◙ The Animation Studio 1.0 ..... 72.



PC Connection ... 1 year

Bring out the power of Windows or any number of applications by boosting your memory.
5510 *1 MB x 9 SIMMs (80 ns)*..... **$45.**
2497 *4 MB x 9 SIMMs (80 ns)*..... **139.**
5746 *1 MB Chips (80 ns, set of 9)* ..... **45.**

HARDWARE

Warranties listed next to manufacturer.

3 Com ... lifetime (conditional)
3453 EtherLink II/16... 159. 3469 II/16 TP.. 169.
American Power ... 2 years
7108 Smart UPS 400 339. 7105 UPS 600 439.
3819 Back-UPS 250. 115. 3858 UPS 400 . 179.
7107 Back-UPS 450. 215. 3823 UPS 600 . 295.
Appoint ... limited lifetime
2469 Thumbelina PC or 2480 MousePen Pro PC 62.
ATI Technologies ... 5 years
9985 VGA Integra *(1024 x 768, 16 colors)*..... 84.
8463 VGA Wonder XL24 *(with 1 MB)*..... 149.
3886 Graphics Ultra + *(with 2 MB)*..... 339.
3871 Graphics Ultra Pro *(with 2 MB)*..... 519.
2382 Graphics Vantage VGA *(with 1 MB)*..... 225.
3902 Stereo•F/X *(sound board)*..... 109.
Boca Research ... 5 years
7150 BOCARAM/AT PLUS *(2 MB)* ..... 159.
7139 *(4 MB)* ..... 225. 7138 *(8 MB)*..... 345.
8398 External 14,400 Baud V.32 FaxModem 275.
8397 Internal 14,400 Baud V.32 FaxModem 219.
6998 I/O Board for AT.. 49. 6999 for PS/2 .. 89.
8380 BasicVGA.... 49. 8381 SuperVGA... 115.
Bravo Communications ... 2 years
7400 2 Position Laser Compatible Switch Box 109.
7501 CPS1021 *(electronic switch box)*..... 135.
Caere ... 1 year
8158 Typist Plus Graphics ..... 299.
Canon ... 1 year
We are an authorized Canon Service Center.
7894 BJ-10ex Printer *(4.6 lb.)* ..... 299.
8940 BJ-C800 Color BubbleJet Printer ..... 1899.
7897 BubbleJet Ink Cartridge *(BJ-10ex)* ..... 23.
Cardinal ... 1 year
8689 386SX-33 MHz Motherboard ØK ..... 275.
8690 MVP24I Modem Value Pack ..... 39.
8691 MVPI24IF FaxModem Value Pack ..... 64.
Chips & Technologies ... lifetime
6137 SuperMath 387DX-25..... 55.
6138 387DX-33.... 65. 8388 387SX-33 .... 84.
CoStar ... 1 year
1947 LabelWriter II ..... 185.
COVOX ... 1 year
5543 Sound Master II ..... 145.
Creative Labs ... 1 year
8578 Sound Blaster ..... 99.
2336 Sound Blaster Pro ..... 189.
Curtis ... lifetime
1708 Ruby-Plus SPF-2+..... 59.
7358 Command Center SPF-4..... 79.
Cyrix Corporation ... 5 years
MATH COPROCESSORS
9877 FasMath 83S87-16 *(SX compatible)*..... 69.
9875 FasMath 83D87-25 or 9876 83D87-33 *ea.* 89.

PC World Class Rank.

Hayes ... 2 years
7395 OPTIMA 144+FAX144—Affordable V.32bis/14,400 bps data & Group 3/14,400 bps FAX. Sets best combination of speed, error control, & data compression, Includes free *Smartcom* data & FAX software ..... **$479.**

Diamond Computer ... 5 years

8333	SpeedStar 24X Graphics Accelerator ..	175.
6945	Stealth Hi-Color	239.

Epson ... 2 years
We are an authorized Epson Serivce Center

5555	AP-3250 *(80 col., 200 cps, 24 pin)*	229.
1906	FX-850 *(80 col., 264 cps, 9 pin)*	319.
1904	FX-1050 *(136 col., 264 cps, 9 pin)*	449.
2358	LQ-570 *(80 col., 252 cps)*	289.
2361	LQ-870 *(80 col., 330 cps)*	489.
2357	LQ-1170 *(136 col., 330 cps)*	669.
5184	LX-810 *(80 col., 180 cps, 9 pin)*	185.

Hauppauge Computer ... 1 year

9034	33 MHz 386 Motherboard for AT *(1 MB)*..	789.
4008	WinTV	439.

Hayes ... 2 years

7391	ULTRA 96 Modem	599.
5024	ULTRA 144 Modem	669.
1345	OPTIMA 24 Modem	149.
3522	OPTIMA 96 Modem	379.
8187	OPTIMA 24+FAX96	159.
7395	OPTIMA 144+FAX144	479.
9884	Pocket Edition 2400	119.

Hewlett-Packard ... 1 year

3175	DeskJet 500C *(color) (with toner)*	749.
3957	LaserJet IIP Plus *(with toner)*	879.
9993	LaserJet IIIP *(with toner)*	1099.
6442	LaserJet IV *(with toner)*	call

Intel ... 3 years

3864	14.4EX Modem	469.
1086	Matched Memory Classic Memory Brd. 0k..	98.
5992	SatisFAXtion Modem 200	299.
5994	Modem 400. 399. 5995 Modem 400E	449.
5999	FAXability Plus *(software)*	79.
6003	FAXability Plus OCR *(software)*	165.
2994	EtherExpress 16 or 3021 16 TP .... *ea.*	129.
5418	OverDrive Processor *(for 486SX-25 MHz)*	499.
8943	OverDrive Processor *(for 80486DX-33)*....	669.

MATH COPROCESSORS

4750	80387SX *(all 80386SX CPU's)*	79.
5409	80387DX *(all 80387DX CPU's)*	85.

Kensington Microware ... 1 year
Full line available. Partial listing.

4973	PowerTree 20 *(6 outlets, EMI/RFI Filtering)*	24.
2582	Master Piece Plus 95. 2587 Remote	105.
7899	Expert Mouse *serial*... 99. 7900 *bus*...	115.
3311	MasterStand	59.

Key Tronic ... 3 years

4518	101 Plus Keyboard	99.

Kraft Systems ... 5 years

8346	Jet Fighter 2 with Thunderstick	39.

Logitech ... limited lifetime

3996	Trackman2 *(combo)*	$84.
2343	Trackman Portable	99.
7975	ScanMan 256	269.
1015	ScanMan Color	619.
3295	MouseMan *(combo)* 69. 9766 *(cordless)*	89.

MediaVision ... 3 years

5637	ProAudio Spectrum 16	199.
8404	Thunder & Lightning	219.
5638	MultiMedia PC Upgrade Kit 16	969.
6829	CDPC	999.

Microsoft ... lifetime

7597	Microsoft Mouse *(bus or serial)*	85.
2898	Mouse with Windows 3.0 *(bus or serial)*	149.
1896	Ballpoint Mouse *(serial only)*	119.

MicroSpeed ... 1 year

6007	PC-TRAC Trackball *serial*	75.

Microtek ... 1 year

5187	ScanMaker II	879.
5175	ScanMaker IIXE	1099.

Mouse Systems ... lifetime

3213	PC Trackball II *(serial)*	55.
7878	PC Mouse III *(serial)*	69.
5979	NewPoint	62.
5978	PenMate	209.

Intel ... 3 years
Intel SatisFAXtion Modems—Fax from Windows or DOS as easily as you print. In 4 different performance ranges and prices. Now includes Faxability Plus software - thru 12/31/92..... **see line listings.**

Mustek ... 1 year

8454	Matador 105 for DOS	95.
8450	Color Artist for Windows	319.

NEC ... 2 years

4252	MultiSync 3FGX Monitor *(14")*	689.
4249	4FG Monitor *(15")* 799. 3151 5FG *(17")*	1449.
5377	SilentWriter Model 95 PostScript Laser	1439.

Okidata ... 1 year
We are an autorized Okidata Service Center.

5093	OL400 Page Printer *(4 ppm)*	649.
9590	OL810 Page Printer	1089.
5094	OL830 Page Printer *(8 ppm)*	1299.
3025	Toner Cartridge	25.

Orchid Technologies ... 4 years

7863	ProDesigner VGA IIS *(with 1 MB)*	189.
4071	Fahrenheit 1280i with 1 MB	299.

800-800-0004

MMC

PC Connection 0004
6 Mill Street
Marlow, NH 03456
SALES 603-446-0004 **FAX** 603-446-7791

MediaVision ... 3 years
6829 *CDPC*—Includes P.A.S. 16 card, speakers, Sony CD-ROM Drive & software .... **$999.**
5637 *ProAudio Spectrum 16*—CD quality audio card. Attach virtually any CD-ROM Drive via SCSI-2 Port ..... **199.**

Pacific Data ... lifetime/60 day MBG
Memory upgrade for LJ IIP, III, IIID, IIIP:

7055	*2 MB* ..... 119. 7759 *4 MB*.....	199.
7158	Pacific Page PE *(LJ IID, IIP, III, IIID, IIIP)*.	299.
5729	ProTracer *(personal CAD printer) (1 yr.)*	1099.

PC Power & Cooling ... 2 years

3203	Turbo Cool 200	149.
7915	Turbo Cool 300	159.

Practical Peripherals ... lifetime

3102	PM2400 Modem *(external)*	99.
8993	PM2400 Modem *(internal, V.42bis)*	115.
8994	PM2400 Modem *(external, V.42bis)*	125.
8132	PM2400 Pocket Modem	109.
2266	PM9600 Internal Modem	275.
7934	PM9600SA Modem	289.
2264	PM2400FX96 *(internal modem/fax)*	95.
1344	PM2400FX96SA *(external modem/fax)*..	99.
3803	PM14400FX96 *(internal modem/fax)* ...	359.
2425	PM14400FXSA *(external modem/fax)*..	399.

Solectek ... 1 year

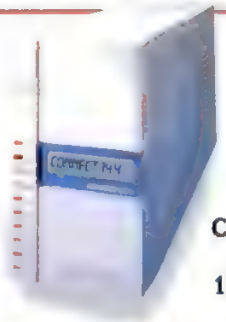
4804	Pocket Fax Windows	189.
4769	Pocket LAN Ethernet	239.

Standard Microsystems ... 5 years

6376	Ethercard Plus Elite 16 or 6370 16T *ea.*	139.

Targus ... lifetime

1305	Universal Notebook *(computer case)*	69.



Free Checkfree thru 12/31/92.

Practical Peripherals ... lifetime
2425 *PM14400FXSA Modem/Fax*—Get ultra high speed 14,400 bps data transmission as well as Group III S/R fax capabilities in one integrated and affordable package. Includes *QuickLink II* for modem and fax communications **$399.**

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3rd year in a row!

Technology Concepts ... 2 years
6315 Fax Line Manager 203 ..... $125.
TheComplete PC ... 2 years
6069 TheComplete Modem Plus ..... 95.
8599 TheComplete Turbo Modem Plus *(Ext.)* 289.
8593 TheComplete Communicator Gold..... 479.
5140 TheComplete Page Scanner w/OCR ... 579.
Tripp Lite ... 2 years
6199 Isobar 4-6 *(4 outlets, Gold Seal Warranty)* 49.
6200 Isobar 6-6 *(6 outlets, Gold Seal Warranty)* 59.
8630 Isobar Ultra 6 *(diagnostic circuitry)* ..... 52.
9312 BC500 Power Backup ..... 219.
6506 BC1250 LAN Power Backup ..... 499.
6018 LC1200 *(line conditioner)* ..... 159.
1528 PS6.0 *(600VA online UPS)* ..... 559.
Zoom Telephonics ... 7 years
1307 Int. 2400 Baud w/9600 Baud Fax Modem 79.
1178 Ext. 2400 Baud w/9600 Baud Fax Modem 92.
1494 Ext. 9600V.32bis... 195. 3075 Int. ... 195.
3574 Ext. 2400 Baud V.42/9600 Baud Fax ... 115.
3386 FaxModem AFC *(2400 baud 96S/48R)*.. 59.
4430 FaxModem AFX *(2400 baud 96S/48R)*.. 79.
4429 FaxModem V.32bis 14,400 baud *(int.)*. 219.
4428 FaxModem V.32bis 14,400 baud *(ext.)* 259.
7921 Pocket FaxModem ..... 87.

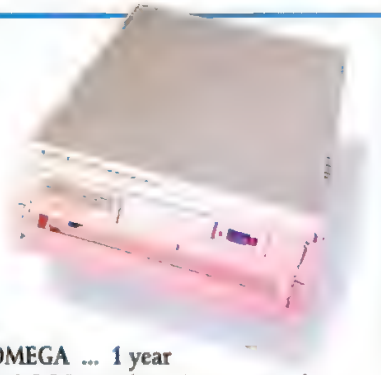
AddStor
4090 ▣ *SuperStor 2.0*—Double your disk capacity with an advanced, feature-rich software-only data compression product. Easy to install and use. Compatible with Windows and all applications ..... **$59.**

DRIVES

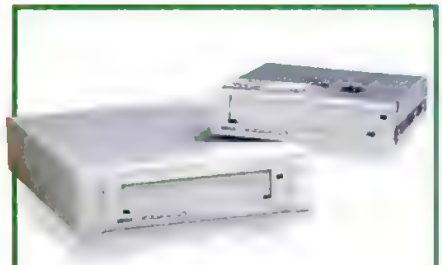
Colorado Memory Systems ... 1 year
4194 Jumbo 120 Tape Backup ..... 199.
4354 Jumbo 250 Tape Backup ..... 269.
1073 Trakker 250 Tape Backup *(parallel)*..... 429.
Conner Peripherals ... 1 year
2339 CP30104H 120 MB IDE HD *(19 ms)*.... 319.
1337 CP3204 200 MB IDE HD *(16 ms)*..... 539.
3511 CP3544 500 MB IDE HD *(12 ms)*..... 979.
IOMEGA ... 1 year
We are an authorized Iomega Service Center.
6499 Transportable 90 PRO ..... 679.
6502 Insider 90 PRO 579. 6501 Dual 90 PRO 1479.
6343 PC Powered 90 *(incl. PC2B & cart.)*..... 499.
6344 PC Powered 90 PRO *(incl. PC2B, cartridge & Central Point Software)*..... 599.
2500 PC2B-2 Controller ..... 149.
2530 90 MB Cartridge.. 149. 2467 Tripak .. 439.
8480 Tape250 Insider Tape Backup ..... 239.
8481 Tape250 Inside Half-Height Tape Bckp 259.
8482 Tape250 PC Powered Tape Backup.... 359.
NEC ... 2 years
6577 CDR37 Portable CD-ROM Drive ..... 399.
6582 CDR74 Portable CD-ROM Drive ..... 589.
6581 CDR84 for PC/XT/AT ..... 499.
7023 MPC Upgrade Kit *(with CDR37)*..... 949.
7021 MPC Upgrade Kit *(with CDR84)*..... 1079.
Pacific Rim ... 1 year
1304 1.2 MB External *(for any parallel port)*.. 239.
2761 1.44EX MB Ext. *(for any parallel port)*.. 239.
Quantum ... 2 years
8304 Plus Hardcard II XL 50 MB *(9 ms)*..... $225.
8287 Plus Hardcard II XL 105 MB *(9 ms)*..... 389.
Summit Memory Systems ... 2 years
6436 SE120 Tape Backup ..... 215.
TEAC ... 1 year
6951 1.2 MB Drive for AT ..... 65.
4670 1.44 MB Drive for PC/XT *(3½")* ..... 59.
4326 1.44 MB Drive for AT *(3½", w/Bastech)* 75.
4414 3½ "/5¼ " Dual Floppy Drive ..... 145.

MEMORY

6556 256k DRAMs *(100 ns, set of 9)* ..... 19.
5510 1 MB x 9 SIMMs *(80 nanosecond)*..... 45.
2497 4 MB x 9 SIMMs *(80 nanosecond)*..... 139.
5746 1 MB Chips *(80 ns, set of 9)*..... 45.



IOMEGA ... 1 year
6343 *PC Powered 90*—Lowest priced Bernoulli drive ever in one complete, convenient package. Includes 90 MB cartridge, PC2B interface card, and cable..... **$499.**
6344 *PC Powered 90 PRO* ..... **599.**



IOMEGA ... 1 year
Tape250—QIC & Irwin compatibility in one affordable tape drive! Stores 250M & includes data compression & *Central Point Backup*.
8480 *Tape250 Insider Tape Backup*..... **$239.**
8481 *Insider HH* **259.** *8482 PC Powered* **359.**

DISKS/MEDIA

Fuji ... lifetime
2214 3½" DS Disks*(10)*.... 9. 2242 *(50)*..... 32.
2215 3½" HD Disks*(10)*.. 15. 2241 *(50)*..... 59.
2239 3½" HD Color Disks *(Qty. 10)*..... 16.
2243 3½" DS Color Disks *(Qty. 10)*..... 10.
Sony ... lifetime
3292 5¼" HD Disks*(Qty. 10)* ..... 11.
3297 3½" DS Disks *(10)*..... 9. 6148 *(30)*.. 25.
3298 3½" HD Disks *(10)*... 15. 6375 *(30)*.. 42.
8185 QD2040..... 14. 1895 QD2120..... 21.
3M ... lifetime
3943 DC2000..... 17. 1581 DC2120..... 23.
Toshiba ... 2 years
4858 3½" 2.88 MB ED Disks *(Qty. 5)*..... $28.
9755 3½" 2.88 MB ED Disks *(Qty. 10)*..... 53.

OUR POLICY

- We accept VISA and MASTERCARD.
- No surcharge added for credit card orders.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order (in the U.S.).
- No sales tax, except Ohio residents (please add applicable tax).
- All U.S. shipments insured; no additional charge.
- APO/FPO orders shipped 1st Class Mail.
- International orders U.S. $100 minimum. Manufacturer support and upgrade eligibility may be limited outside the U.S.A.
- Upon receipt and approval, personal and company checks clear the same day for immediate shipment of your order.
- Corporate P.O.s accepted subject to approval.
- COD max. $1000. Cash or cashier's check. COD orders require an additional $4 charge.
- 120 day limited warranty on all products. Defective software replaced immediately. Defective hardware repaired or replaced at our discretion. All items subject to availability. Prices and promotions subject to change without notice.
- Our order lines are open continuously from 8:00 a.m. Monday until 5:00 p.m. Sunday Eastern Time. You can call our business offices at 603-446-3383 Monday through Friday 9:00 a.m. to 5:30 p.m. Eastern Time.

Zoom Telephonics ... 7 years
High-speed 9600 bps data transfer is now affordable for everyone. These modem provide V.42bis compression, MNP 2-5 & a seven year warranty.
1494 *External 9600 V.32bis Modem* .... **$195.**
3075 *Internal 9600 V.32bis Modem*..... **195.**

SHIPPING

Continental U.S.: The total freight charge on any order placed with PC Connection is only $5. Barring events beyond our control, all credit card orders phoned in weekdays by 3:00 a.m. Eastern Time will ship Airborne Express for delivery the next business day. Which means *same day* delivery for orders placed between midnight and 3:00 a.m. Eastern Time. (Some orders may ship by UPS Ground for next day delivery). Saturday delivery available to many areas upon request at no additional charge. Order all day Saturday through noon on Sunday for Monday delivery. (Some areas require an additional day delivery).
Hawaii, Alaska, Canada, Puerto Rico and the U.S. Virgin Islands: Call 800-800-0004 for information on shipping and charges.
All other areas: Please call 603-446-0004 or FAX 603-446-7791 for information.

Are you ready to test our medal?

We always go for the gold up here in the over-achieving village of Marlow, NH (pop. 602). Whether it's shipping overnight until the last possible minute, or finding the answer to a difficult technical question, we'll do whatever it takes to make buying PC products fast and easy. So we're pleased as punch (and twice as sparkling) to learn that we were once again voted the people's choice for Best Mail-Order Company in the *PC World* 1992 World Class Awards!

Order until 3:00 a.m. Dec. 24th!

Amazing, huh? We've earned our World Class awards thanks to service breakthroughs like Everything Overnight,® (just $5 for all orders in the continental U.S.). Which comes in particularly handy during that last-minute Christmas shopping. Call by 3:00 a.m. ET on December 24th and if your order is in stock we'll put it on an Airborne plane by 4:00 a.m. You may actually get your PC gift before the crowded malls open that very morning! But, in any event, it should arrive in plenty of time to put it under the tree. Happy Holidays!

PC CONNECTION

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▶ SUMMARY OF FEATURES

■ = YES □ = NO

	BitFax/OCR for Windows	DosFax PRO	Eclipse FAX	FAXability Plus	Faxit for DOS	Faxit for Windows	FaxMaster
Phone Books (continued)							
Imports phone book data	□	■	■	■	□	■	■
ASCII (comma delimited)	N/A*	■	■	■	N/A*	■	□
DBF	N/A*	□	□	■	N/A*	□	■
Other	N/A*	None	WinFax PRO	Faxit, .PB	N/A*	ASCII (tab-delimited)	None
Reads phone book data from external database	■	□	□	□	□	□	■
Maintains telephone and fax numbers	□	□	■	■	□	■	□
Allows notes	□	■	■	■	□	□	□
Allows permanent transmission groups	■	■	■	■	□	■	■
Allows selection of multiple recipients	■	□	■	■	■	■	■
Receiving and Viewing							
Includes separate DOS receive module	□	□	■	□	■	■	□
User can view a full page	■	■	■	■	■	■	■
User can view a partial "quick-read" page	■	■	■	□	□	■	□
Includes send, receive log	■	■	■	■	■	■	■
Log includes visual thumbnail sketches	□	□	□	□	□	□	■
Reinverts pages transmitted upside down	■	■	■	■	□	□	■
Straightens crooked images	□	□	□	□	□	□	■
Fax Management							
User can store faxes with search index	□	□	■	□	□	□	□
User can attach notes to stored faxes	□	■	■	□	□	□	□
Compresses fax images for storage	□	□	■	□	□	□	■
User can search by							
Date/time	□	□	□	■	□	□	□
Index	□	□	■	□	□	□	□
Sender	□	□	□	■	□	□	□
Automatic deletion by date	□	□	□	□	□	□	□
Printing							
Printers supported							
Epson X3X series	■	■	■	■	■	■	■
HP PCL 4	■	■	■	■	■	■	■
IBM Proprinter	■	■	■	■	■	■	■
PostScript	■	■	■	■	□	■	■
Other	All printers supported by Windows	130 others	All printers supported by Windows	All printers supported by Windows	None	All printers supported by Windows	All printers supported by Windows
Prints automatically on reception	□	■	■	□	□	□	■
Prints selected page	■	■	■	■	□	■	■
Prints selected range of pages	■	■	■	■	□	■	■
Prints selected area	□	□	■	□	□	□	□
Prints in the background	■	□	■	■	□	■	■
Scanning Support							
Supports scanners	□	□	■	■	□	□	■
Complete PC	N/A*	N/A*	■	□	N/A*	N/A*	■
HP ScanJet and compatibles	N/A*	N/A*	■	■	N/A*	N/A*	■
Logitech ScanMan	N/A*	N/A*	□	■	N/A*	N/A*	□
Other	N/A*	N/A*	Fujitsu, Microtek	TWAIN compatible scanners	N/A*	N/A*	45 others
Scans document directly to fax	N/A*	N/A*	■	■	N/A*	N/A*	■

	FaxTalk Plus	The Fax Window	Mirror III Fax	MTEZ Standard with ExpressFax	PaperWorks	SuperFax for Windows
	■	□	□	□	■	■
	■	N/A*	N/A*	N/A*	□	■
	□	N/A*	N/A*	N/A*	□	□
	None	N/A*	N/A*	N/A*	ASCII (tab-delimited)	None
	■	□	□	□	□	□
	■	□	■	□	■	□
	■	□	■	□	□	□
	■	■	□	■	■	■
	■	■	■	■	■	■
	■	□	■	□	□	□
	■	■	■	■	■	■
	■	□	■	□	■	■
	□	□	□	□	□	□
	□	□	□	□	□	□
	□	■	□	□	■	■
	□	□	□	□	□	□
	□	□	□	□	□	□
	□	□	□	□	□	□
	□	□	□	□	□	□
	■	■	■	■	■	■
	■	■	■	■	■	■
	■	■	□	■	■	■
	■	■	■	□	■	■
	None	All printers supported by Windows	None	Canon BJ 10e, Diconix 150, Epson 2Q HP DeskJet, IBM Graphics, Panasonic KX-P1124i and KX-P1180	All printers supported by Windows	All printers supported by Windows
	□	□	□	■	□	■
	■	□	■	□	□	■
	■	□	□	□	□	■
	□	□	□	□	□	□
	□	■	□	□	■	■
	□	□	□	□	□	■
	N/A*	N/A*	N/A*	N/A*	N/A*	□
	N/A*	N/A*	N/A*	N/A*	N/A*	■
	N/A*	N/A*	N/A*	N/A*	N/A*	□
	N/A*	N/A*	N/A*	N/A*	N/A*	CalComp ScanPlus, Chinon, Ricoh
	N/A*	N/A*	N/A*	N/A*	N/A*	■

ENDS

a fax can significantly slow down Windows operations, especially while the modem is making its connection.

FAXability Plus's toolbar makes it easy to use the management parts of the software. You can access commands such as View or Print with a single click.
The program maintains separate in-box and out-box logs, which you can customize to limit the types of items shown and to change the order in which they appear. You can even create additional logs to suit your needs. The program also supports the new TWAIN scanning standard

FAXability Plus's main attraction is ease of use. If you can print a document through Windows, you can fax it with this program.

for Windows. There is even an option to let you fax directly from the scanner.

INABILITIES

The program's limitations include its thin manual, which is organized by command in alphabetical order and does not provide a logical flow to the topics. There is, however, a good index that does makes it somewhat easier to find information.

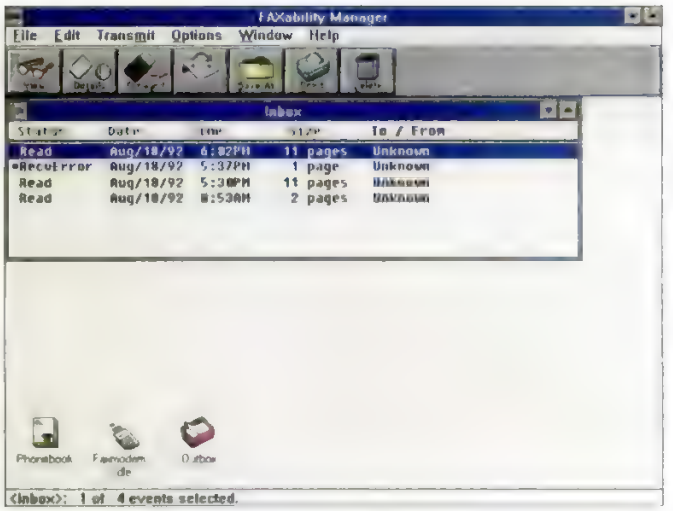
There is no facility to import data into the program's phone book, though you can download an import utility for free from the Intel BBS. And while phone book entries do have a comment field, it's limited to a meager 69 characters.

The program has other quirks; for ex-

SUITABILITY TO TASK

FAXability Plus

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	●	○
Receiving	●	●	●	○
Fax management	●	●	○	○
Printing	●	○	○	○



Intel Corp.'s FAXability Plus has an attractive and functional interface, with buttons for access to the major functions, and module icons at the bottom that change to indicate their status.

ample, its conversion process to fax complex graphics images in landscape orientation. According to the README file, this can take "significantly longer" than converting portrait images to fax—"minutes or even hours longer in extreme cases." The program cannot send gray-scale images, either; they get converted to black and white which can result in loss of detail.

Perhaps FAXability Plus's most frustrating restriction is its inability to resend a fax, even though it lets you forward received faxes. On the other hand, if you select the Save File option when you send an original fax, you can resend it later.

FAXability Plus adroitly performs most of the basic tasks you will want it to do, but you may well find one of the other products better suited to your needs.

SofNet Inc.

Faxit for DOS

BY ALFRED POOR

There was a time when SofNet's Faxit for DOS might have turned some heads, but that time has passed. The $79 list price of Version 2.5 is certainly affordable enough, but the program is thin on features. You're likely to find it frustratingly limited.

Installation is fairly straightforward. The install program steps you through a series of configuration screens (which include on-line help for each screen). The only problem we had was that the modem-selection screen listed only one Intel modem, and we were testing with a Class 1-compatible modem and a CAS-compatible modem, both from Intel. SofNet's technical support instruction to use the same setting for both modems was only partially correct; this method works for the Class 1 modem only if you have Intel's CAS-compatibility driver already loaded.

A ROUGH RIDE

The package's more serious flaws don't really appear until you actually run the program. You'd best keep Faxit for DOS's manual handy since there is no on-line help for the program itself. The manual has a thin but serviceable index that can help you navigate your way through the pages.

Faxit for DOS relies on a 30K to 60K TSR that handles the scheduling of outgoing faxes and receives incoming ones (although this TSR is not required for CAS modems.)

You send faxes using files saved to disk. One especially welcome feature is that you can capture print output formatted for an HP LaserJet III. Or you can opt to send files in text or .PCX format. The program keeps a log of transmissions, marking them with "Success" or "Error" depending on the result. You can also get additional detail on each fax, such as time sent and number of pages.

DON'T CALL US...

The program lets you maintain an unlimited number of phone books, but there is no way to import data from other databases or files. Even if Faxit for DOS did have import features, they would be of diminished value since each phone book is limited to 50 entries, and each of those entries is limited to just a name and a phone number.

Faxit for DOS's flaws don't really appear until you actually run the program. Also, keep the manual handy since there's really no on-line help.

There are other limitations to Faxit for DOS, such as the stunted editor that lets you add text messages to fax cover sheets, but offers no end-of-line wrap feature. This means that you have to press Enter at the end of each line as you create the cover sheet. The program cannot fax gray-scale images, and can only handle .PCX files in one-bit color (black and white) format.

SUITABILITY TO TASK

Faxit for DOS

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	○	○
Receiving	●	●	○	○
Fax management	●	○	○	○
Printing	●	○	○	○

FACT FILE

Faxit for DOS, Version 2.5

SofNet Inc., 380 Interstate North Pkwy., #150, Atlanta, GA 30339; 800-343-2948, 404-984-8088; fax, 404-984-9956

List price: $79; with Faxit for Windows, $119.
Requires: 640K RAM, 2MB hard disk space, DOS 3.0 or later.
In short: Faxit for DOS has limitations, even for a DOS character-based program, and while it can send and receive faxes, there are more attractive alternatives.

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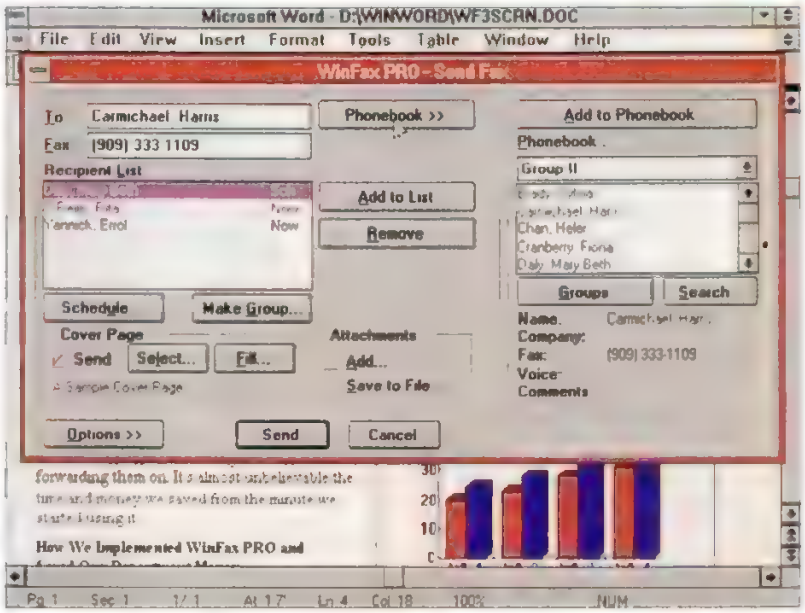
WinFax PRO 3.0's document management tools enable you to file, track and quickly find faxes you've sent or received. Plus, you can mark-up any faxed document with text and graphics, using our fully-featured annotation tools. We've also included AnyFax™, the industry's most advanced OCR software for fax documents, so you can convert faxes into editable files for your word processor or spreadsheet.

PLUS, as a special introductory offer, WinFax PRO 3.0 contains Cover Your Fax™, over 50 unique cover sheets designed by nationally syndicated cartoonist John Caldwell. Perfect for your business or personal use, and suitable for any situation. **A FREE $39.95 value, for a limited time only.**



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CIRCLE 250 ON READER SERVICE CARD

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Truly network-ready

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BOTH MODELS: *Up to 800 x 400dpi (COMPAQ High-Resolution Mode) ♦ PostScript Level 2 and PCL 5 w/Intelligent Emulation Sensing ♦ One slot/port each for AppleTalk, Network Interface Cards, Internal FAX Modem, Serial and Parallel Port ♦ Available Options: Internal 60-MB Hard Drive, 1- and 2-MB Programmable Font Modules ♦ Consumables: One-piece cartridge with 12,000-page yield*

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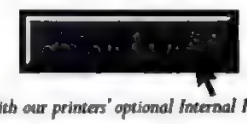

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CIRCLE 203 ON READER SERVICE CARD

Extending the Fax

by Alfred Poor

Fax capabilities can be the backbone of a more ambitious PC-based data management system. Wouldn't it be great if your computer could answer dial-up requests for information? Or how about having your computer receive a fax from someone and record the information the fax contains directly into a spreadsheet or database? Maybe you'd like to be able to send a fax to your computer while you're on the road, a fax that would have your computer send an important document to you—or anyone else you choose. This isn't futuristic fiction; these features exist in products you can purchase today.

DIALING FOR DATA

There are three different automated fax information systems: FactsLine from Ibex Technologies, FaxBack from FaxBack Inc., and FaxFacts from Copia International.

Features and options vary, but the fundamental concepts are the same: A user calls the system either from a regular phone or from a fax machine. A digitized voice system offers a menu of available documents, and the caller responds using the numeric keypad on the phone. The system then either transmits the requested documents to the fax machine used to place the call or hangs up and calls a fax number that was provided by the user during the session.

In any case, users gets up-to-the-minute information without having to wait for someone to mail or Federal Express the documents to them. The sending company saves time and money because the system can be used to handle basic information and technical support requests, leaving the human support staff available for more complex tasks.

Even if you do not have a large-scale operation, you can still benefit from this type of system. Your customers can use it to get up-to-the-minute pricing information or new product announcements. A password protection scheme makes it possible for sales reps to retrieve confidential information while in the field, including memos from the home office. With a system like this in place, the possibilities are nearly endless.

DATAGRATION

OCR (optical character recognition) for incoming faxes is certainly handy, but how would you like to have your computer turn incoming faxes directly into data for spreadsheets or databases in a single step? TeleForm from Cardiff Software turns your PC with fax modem into an automated data entry clerk.

Mail or fax your custom data-entry form to customers or field staff, and they fill in the blanks and fax them back to your computer. The product can read the special optical marks as well has handwritten block letters and numbers. Each form has a unique bar code identifier at the top of the page that the program recognizes on incoming faxes. According to the company, TeleForm can handle skewed or distorted forms images.

Wouldn't it be great to be able to send a fax to your computer while you're on the road and have it send an important document to you?

The data can be stored in several formats, including dBASE, Microsoft Excel, Lotus 1-2-3, or Paradox. TeleForm also supports Microsoft Windows' DDE (Dynamic Data Exchange) for linking with Windows applications.

DIGITAL DOCUMENT ASSISTANT

Maybe you are frequently away from your office but need access to documents you have stored on your computer. PaperWorks from Xerox turns your PC into an intelligent assistant that can retrieve and fax files from your computer's storage system and send them to any fax number you specify. It can also store incoming documents that you or others fax to your computer. You can even use it to forward your incoming faxes to you wherever you go.

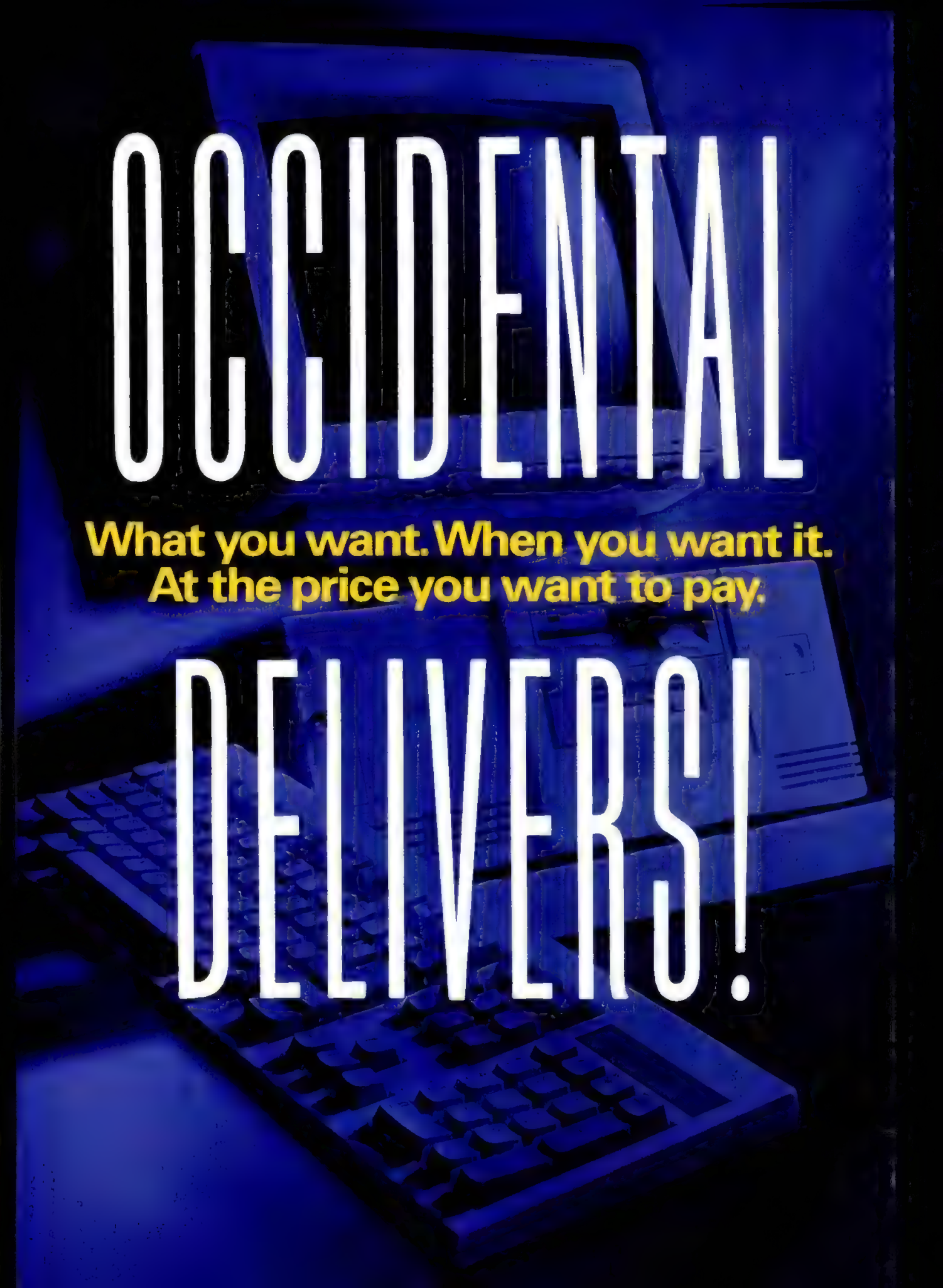
The program uses special paper forms that you fill in and fax to your computer, which "reads" them when they arrive over the phone. The program comes with a supply of generic forms, but you can create your own custom forms to suit your needs. For example, you could create check boxes to indicate individuals or groups to whom you will want to send faxes. You can create lists of documents—such as product descriptions or price lists—so you can have them faxed to yourself or customers while you are away from your office. You can even leave spaces for handwritten cover page annotation. □

FactsLine *Ibex Technologies Inc., 550 Main St., Suite G, Placerville, CA 95667; 800-289-9998, 916-621-4342; fax, 916-621-2004. List price: $2,690 and up.*
Circle 485 on reader service card

FaxBack *FaxBack Inc., 15250 NW Greenbrier Pkwy., Beaverton, OR 97006; 800-873-8753, 503-690-6358; fax, 503-690-6399. List price: $8,450 and up.*
Circle 486 on reader service card

FaxFacts *Copia International Ltd., 1342 Avalon Ct., Wheaton, IL 60187; 708-682-8898; fax, 708-665-9841. List price: $2,545.*
Circle 487 on reader service card

TeleForm *Cardiff Software Inc., 531 Stevens Ave., Bldg. B, Solana Beach, CA 92075; 800-659-8755, 619-481-2255; fax, 619-259-6450. List price: $995.*
Circle 488 on reader service card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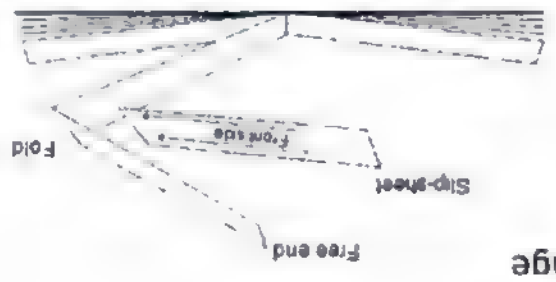
Folded edge of the page

GbsSlipSheet-001

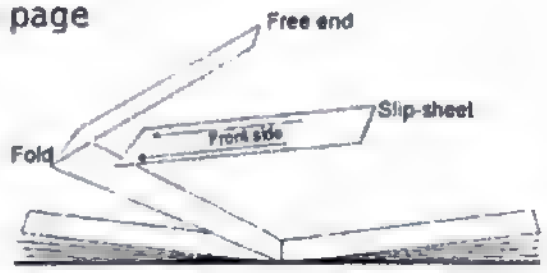
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Back

1. Follow instructions on the other side

GbsSlipBack-001B

Back

1. Follow instructions on the other side

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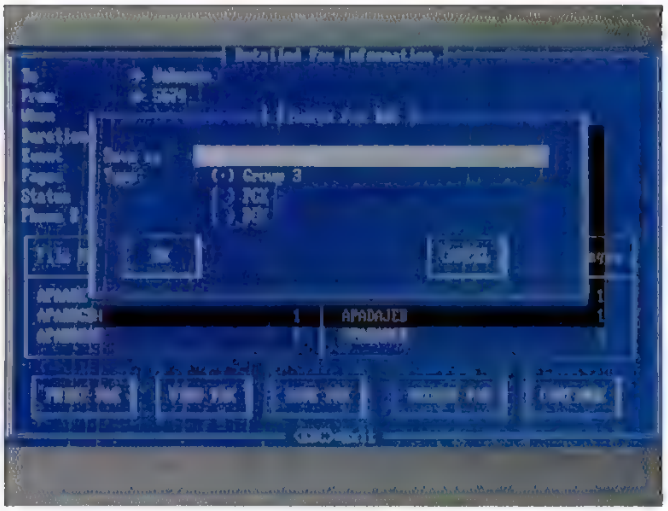


When you select a fax file from the activity log, Faxit for DOS presents detailed information about the fax. You can print, view, or delete the fax, or save it as a Group 3, .DCX, or .PCX file.

Faxit for DOS is available as a standalone fax software product or bundled with SofNet's other version, Faxit for Windows, for $119. If you need a DOS-based fax program for only limited use, it may serve your needs. But if you are looking for full-featured DOS fax software, you can do better with some of the alternatives.

SofNet Inc.

Faxit for Windows

BY ALFRED POOR

SofNet's Faxit for Windows, Version 2.15e, is the $99 Microsoft Windows–based companion to SofNet's Faxit for DOS. You can also buy the two packages bundled for $119. Unfortunately, this is no bargain, as neither Faxit for Windows nor Faxit for DOS holds up well against the other fax software solutions we look at here.

Faxit for Windows' problems surface almost right from the start. For example, if you use a CAS-compatible modem, you only need to install the program under Windows. But if you use a Class 1 modem, you must also install a TSR utility, which you load before entering Windows. Faxit for Windows' install program will add this utility to your AUTOEXEC.BAT file for you. This utility then handles the chores of sending faxes at their scheduled times and answering the phone when an incoming fax arrives. It is rare for a Windows-based software product to rely on a TSR for this sort of function, however, and the loss of available system memory could pose problems for users who run DOS applications within Windows.

HELPLESS

After you install Faxit for Windows, you'll find other limitations. Unlike most Windows applications (but not particularly rare among fax packages), Faxit for Windows has no on-line help files. And despite the diminutive size of the 72-page manual, it's still a challenge to locate information since there is no index and some of the page numbers in the table of contents are incorrect.

Once you have Faxit for Windows running, it works like most other Windows fax applications. It appears as a Windows printer driver, so you can fax from within any application that has a Print command. In the dialog box that appears you can specify the destination details, either using entries from a phone book or entering the information.

FACT FILE

Faxit for Windows, Version 2.15e

SofNet Inc., 380 Interstate North Pkwy., #150, Atlanta, GA 30339; 800-343-2948, 404-984-8088; fax, 404-984-9956

List price: $99, with Faxit for DOS, $119
Requires: 2MB RAM, 1MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0 or later
In short: Faxit for Windows has a limited feature set and poor support materials, which makes it less attractive than some of its competitors.

477 ON READER SERVICE CARD

SUITABILITY TO TASK
Faxit for Windows

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	○	○
Receiving	●	●	○	○
Fax management	●	○	○	○
Printing	●	●	○	○

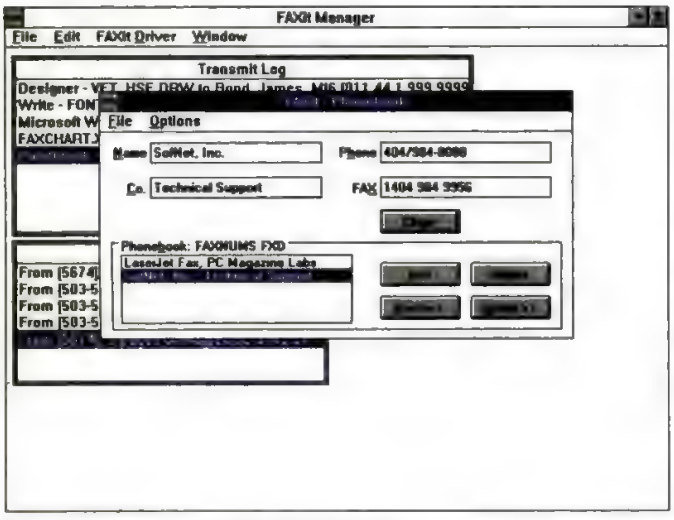
You can have multiple phone books and store as many names and numbers in each as disk space will permit. The phone book records only accept a name, a company name, a voice phone number, and a fax phone number. You can combine phone book files, but Faxit for Windows offers no feature for importing data from other files. SofNet does offer an import utility that handles text files (comma- or tab-delimited). The utility can be downloaded free of charge from the company's electronic bulletin board system.

One of the few advantages that Faxit for Windows has over some of its competitors is that it can transmit gray-scale images.

SMALL COMFORT

The fax management program displays two windows: one each for incoming and outgoing faxes. You need to double-click on an entry to see its full details or to access other options, such as View or the status of the transmission.

One of the few advantages that Faxit for Windows has over some of its competitors is that it can transmit gray-scale images. This is not enough to overcome its other limitations, such as an awkward log format, lack of scanner support, and limited command set. According to a SofNet representative, new products are in the works that will provide OCR features



FAXit for Windows provides three levels of detail about a transmission, starting with the Transmit and Receive logs. At the deepest level, you can see the type of event, resolution, and transmission time.

and support for PIM (personal information manager) products. Until these new versions of SofNet's Faxit line appear, however, you'll probably find a more suitable fax software solution among the competition.

Caere Corp.

FaxMaster

BY ALFRED POOR

Caere has long enjoyed a strong reputation in the OCR field and now brings that experience to the fax software market in FaxMaster, Version 1.0, a $249 Windows-based product that sets new standards for intelligent fax software.

The big story with FaxMaster is the product's OCR capabilities (for more information, read the sidebar "Fax Plus OCR: A New Challenge"). Using AnyFax, a neural network-based OCR engine specially designed to handle fax documents, FaxMaster can take an incoming fax image and automatically convert it into ASCII text. There is an on-screen editor that you can use to examine the converted text and make corrections, as well as Verification Window that pops up the underlying bitmap for you to check against the converted text. There's even a built-in spell checker—almost an absolute necessity with OCR.

You install the program through Windows; the procedure is almost completely automatic. About the only thing the install program cannot do is identify the type of fax modem you have and its port. In a twist appropriate for a fax product, FaxMaster's registration screen lets you use Microsoft Windows' Notepad to fill out the registration. You can then go ahead and test your first fax by faxing the registration to Caere.

NOTHING TO CHANCE

The rest of FaxMaster has similarly thoughtful design features. The incoming and outgoing fax log can present thumbnail views of the faxed documents (up to six documents per screen). Each of the six is labeled with the name of the sender or recipient (if available) and an indication of whether or not the transmission was successfully completed. A status line provides additional details, such as number of pages included in the fax and the date and time of the transmission.

You can work with a fax using the program's menu commands, or you can click on the buttons on a toolbar. These buttons let you print, delete, or view the fax as an image or (if you have set FaxMaster to automatically perform OCR conversion) as text.

To send a fax, you can use FaxMaster as a Windows print driver in much the same way as most other Windows fax programs. The program also can install itself as a new command option under the File menu of most applications. This provides a distinct advantage, since it means you don't have to keep changing your selected printer back and forth between FaxMaster and your printer. While this feature works automatically with some Windows applications, quite a few applications (Micrososft Word for Windows, Excel for Windows, WordPerfect for Windows, and Lotus Development Corp.'s Ami Pro) have their own dedicated FaxMaster macros included in the box. A few other programs cannot show the new command on the File menu. These include Microsoft Works, Ventura Publisher, Lotus 1-2-3 for Windows, and PFS:Works for Windows. With these programs, the FaxMaster command appears under the Control Box menu.

SUITABILITY TO TASK

FaxMaster

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	●	○
Receiving	●	●	●	○
Fax management	●	●	○	○
Printing	●	●	●	○

LET FAXMASTER DO THE WALKING

FaxMaster's phone book records display the name, company, fax number, and group assignment. Since the data is stored in a standard dBASE-compatible .DBF file, it's easy to import data into FaxMaster's phone book from other sources. Furthermore, the phone book can find the data it needs in any dBASE file as long as the selected fields have the correct names (as described in the manual.) This means you can simply rename the fields in an existing data file and FaxMaster will be able to work with them.

FaxMaster supports dozens of scanners, and even has a feature that allows you to send a fax directly from a scanner. The original release of the program does not support the new TWAIN scanner

FACT FILE

PC MAGAZINE EDITORS' CHOICE

FaxMaster, Version 1.0

Caere Corp., 100 Cooper Ct., Los Gatos, CA 95030; 800-643-3915, 408-395-7000; fax, 408-354-2743

List price: $249.

Requires: 4MB RAM, 8MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0 or later.

In short: Even without its OCR capabilities, FaxMaster would be a powerful contender in the Windows fax software market. Its ease of use and powerful features make it an attractive choice.

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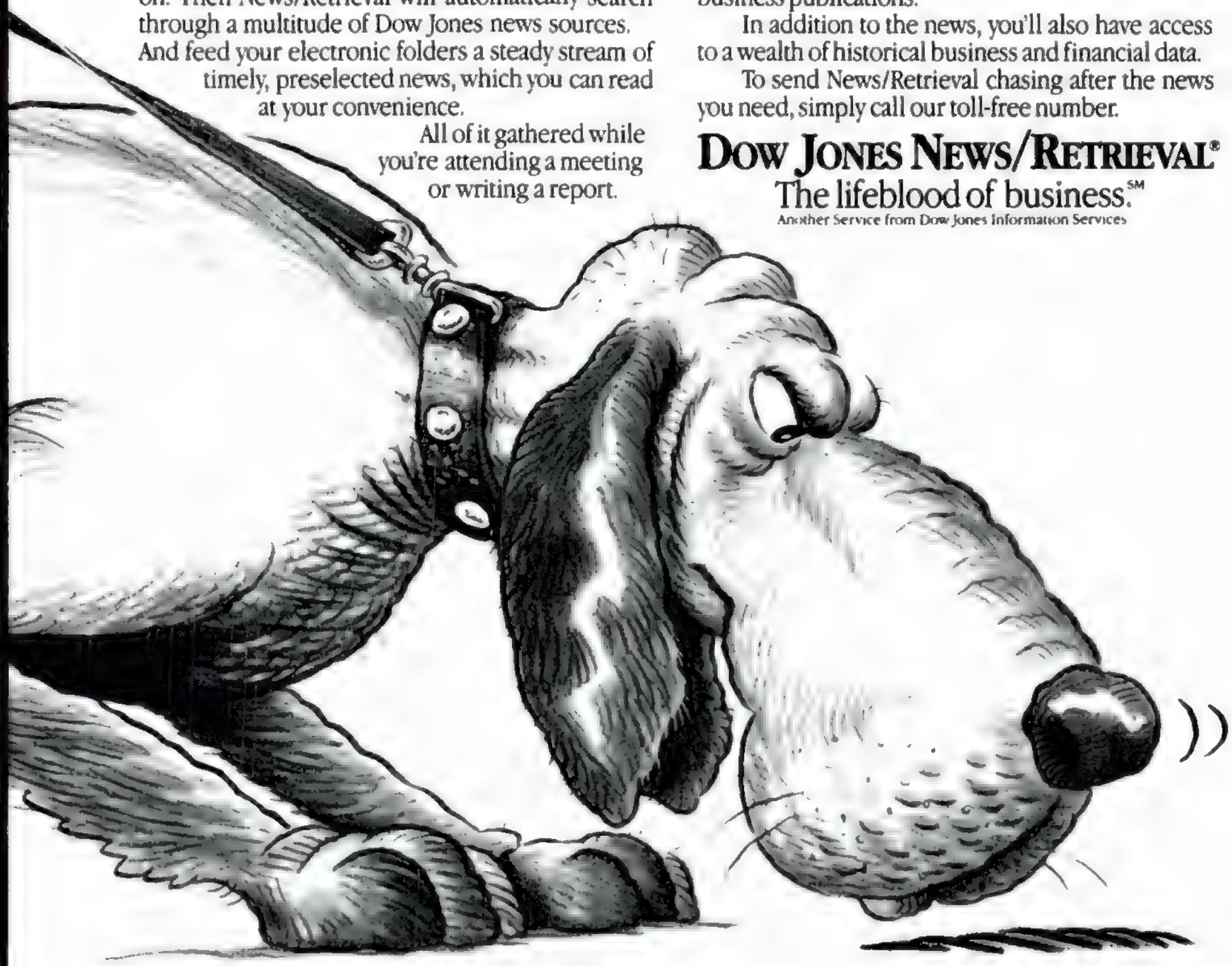

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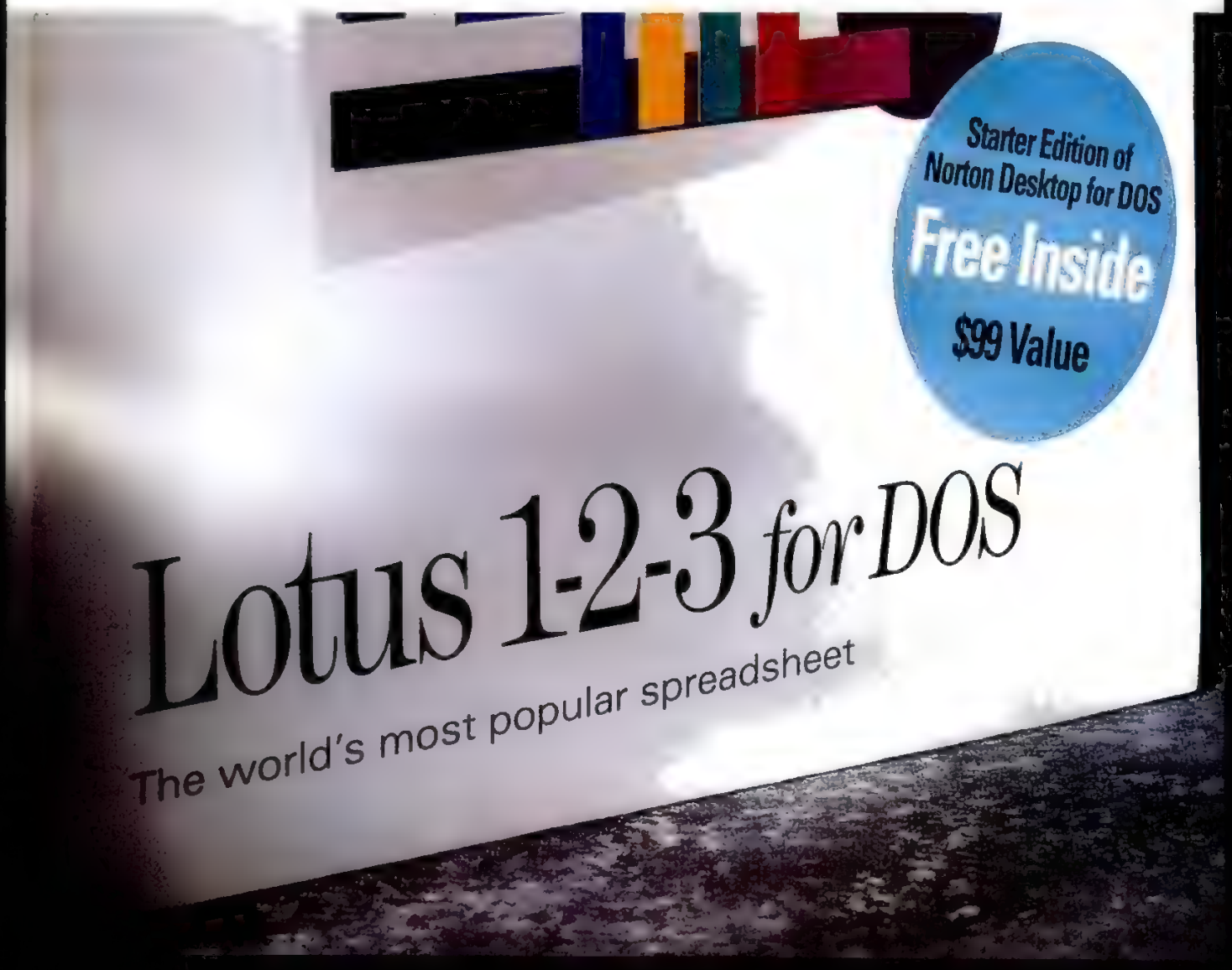

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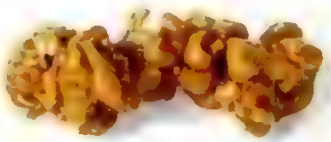

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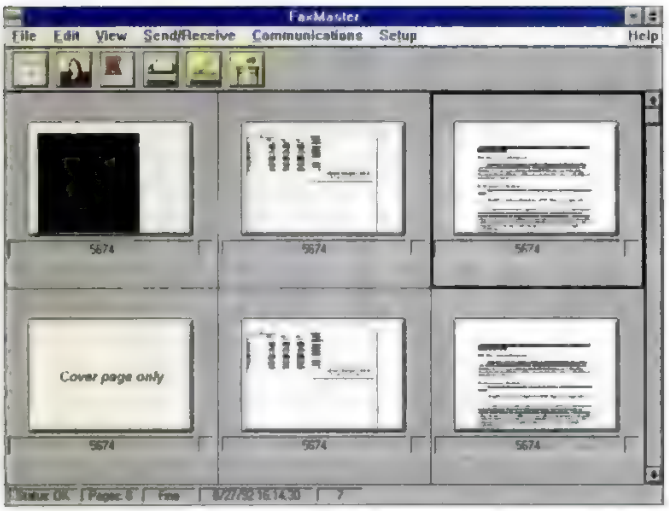

One of the most striking features about FaxMaster is its use of thumbnail displays of faxes as a log. Details of the selected fax are displayed in the status line at the bottom of the screen.

specification, an API (application programming interface) which provides universal Windows support for scanners. But according to Caere, TWAIN support will be added soon and users will be able to download the upgrade free from the company bulletin board system.

FaxMaster is easy to install and use, and its built-in OCR features make it particularly useful where you need to edit incoming text. It has flexibility and power—two hallmarks of many successful products. If you need a fax program for Windows, this one should be on your short list of choices.

Thought Communications Inc.

FaxTalk Plus

BY DAVID MORLITZ

Thought Communications' fax application, FaxTalk Plus, Version 1.65b ($79), contains the simple requisite tools to meet anyone's faxing needs in both the DOS and Windows worlds. And, although limited to Class 1 support, FaxTalk Plus does offer a menu-driven interface simple enough for everyone to use.

ALWAYS ON CALL

FaxTalk Plus operates as a TSR program that can pop up over any text-based application. This 69K TSR (it can be loaded high) helps fill out the cover sheet, and it lets users either type in the fax number or pull the number from one of FaxTalk Plus's address books. It also captures output to the printer, converts that data to FaxTalk Plus format, and sends the fax. Note that the host application must have an Epson FX-80–compatible printer driver to work with the TSR. Faxes can also be sent from within FaxTalk Plus without calling the TSR; in such cases, the package can convert files from ASCII, Dr. Halo, Epson, PCX, and TIF printer files.

FaxTalk Plus's background processing is excellent. The computer can edit documents, format a floppy disk, or even start a brand new DOS application—all while FaxTalk Plus is converting your document.

The package uses drop-down lists that let you select multiple recipients and an unlimited number of files to be sent at whatever time you specify. In addition, FaxTalk Plus can poll remote fax machines and allows local polling of files; it also supports binary file transfer.

FAX WINDOW

By installing the included Windows 3.1 fax driver in the Control Panel, any Windows document can be printed directly to the fax board. Once installed, the fax driver becomes a selection in the Printer dialog box. When a print command is issued, the driver prompts for the phone number and helps fill out a cover sheet.

Unfortunately, FaxTalk Plus still requires its TSR in Windows to receive faxes in the background. With each received fax, FaxTalk Plus records the date and time, the sender's identification, the number of faxed pages, how long it took to receive the fax, and the speed at which the data was transferred.

FaxTalk Plus also comes with a graphical viewer for DOS. You can zoom in or out, and if a fax comes in upside down, you can flip the image. Using a conversion utility provided with FaxTalk Plus, fax files can be easily converted to popular graphic formats, such as PCX. These files can then be edited and converted back to the FaxTalk Plus format. There is also an available Windows version of the fax viewer (contact Thought Communications for more information).

SUITABILITY TO TASK
FaxTalk Plus

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	●	○
Receiving	●	●	○	○
Fax Management	●	○	○	○
Printing	●	●	○	○

MANAGE-UNEASE

Fax management in FaxTalk Plus tends to be rigid and quite limited. Faxes are numbered sequentially, with no option to change their names. Each fax page is stored in a separate file. From inside FaxTalk Plus, the user can only print, delete, or view the fax. Copying faxes directly to other locations can be almost impossible.

FaxTalk Plus's support for printers is limited to Epson's 9- and 24-pin printers, HP LaserJets, and PostScript printers. Received faxes are printed quickly in both draft mode and quality mode. On our test machine, the output to a LaserJet III was significantly better than standard fax machine output.

FaxTalk Plus is a DOS and Windows

FACT FILE

FaxTalk Plus, Version 1.65b
Thought Communications Inc., 275 Saratoga Ave., #200C, Santa Clara, CA 95050; 408-247-2195; fax, 408-247-2199

List price: $69
Requires: 512K RAM, 900K hard disk space, DOS 3.1 or later, Microsoft Windows 3.0 or later for use with Windows fax viewer
In short: FaxTalk Plus is an interesting DOS/Windows hybrid. It is easy to use, flexible, and powerful. There are certain shortcomings in fax management, however
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A New Generation in the Wings

by M. David Stone

Sometimes timing is everything. At the time *PC Magazine* was testing for this overview, two programs— UltraFAX, Version 1.0, from ZSoft Corp. and WinFax PRO, Version 3.0, from Delrina Technology—were in late beta test stage.

Because they were still under development, we couldn't review either package. Neither one, for example, had a finished installation routine, and bugs cropped up in each during our tests. But because they represent the next generation in fax software, we thought it important to preview them. Both should be available by the time you read this. UltraFAX will hit the market at a list price of $119, while WinFax PRO will sell for $129 until the end of 1992 and then $149 thereafter. Users of WinFax LITE, the OEM edition that ships with many fax modems, will be able to upgrade to the new PRO version for $49 by contacting Delrina Technology.

Both UltraFAX and WinFax PRO are Microsoft Windows programs, and both let you fax from any Windows application by printing to a fax driver. They support CAS, Class 1, and Class 2 modem standards. More important, both offer better fax management than most earlier programs. Both, for example, compress files automatically, using the Group 3 standard, to let you fit more files on-disk. WinFax PRO will further compress files for archiving—using Group 4 compression.

WinFax PRO also provides built-in archive management tools. You can create any number of archive groups, add new files to any archive, or look for files in existing archives. The program also provides similar management features for files that have been converted to fax format but have not yet been sent as faxes.

UltraFAX, on the other hand, has no archive management as such, but it will let you copy files to any directory. If you decide you want to copy them back to the UltraFAX data directory, the program will recognize the files as faxes and automatically add them to the appropriate list.

OCR (optical character recognition) is another feature worth noting. WinFax PRO uses Caere Corp.'s AnyFax. This is the same neural net technology that Caere uses in FaxMaster, as opposed to the older Caere technology that several other vendors use. UltraFAX incorporates the OCR engine from Ocron's Perceive. (For a discussion of both of these OCR features, see the sidebar "Fax Plus OCR: A New Challenge." See also the review of Perceive in the July 1992 issue of *PC Magazine*.)

Both programs also offer screen cleaning and anti-aliasing. *Screen cleaning* tries to find random noise in a fax and delete it. Alas, there is also the possibility that it may delete handwritten notes, so you'll want to use the feature with care. *Anti-aliasing*—or smoothing of lines—is meant to increase readability on-screen for small type or high zoom percentages.

Both products stretch the definition of basic features. For example, each offers scanner support. WinFax PRO looks to the future and supports the new TWAIN standard only. UltraFAX does not support TWAIN, but it lists about 45 individual scanners on its scanner setup screen.

WINDOWS INTERFACE CHOICES

Interestingly, the two programs differ greatly in look and feel. Both follow standard Windows conventions, with dialog boxes, toolbars, pull-down menus, and so on. And both offer such attention-grabbing features as drag-and-drop. But they also illustrate how much room there is for variation within these standards.

WinFax PRO uses the typical Windows approach of applying graphical tools to a sequential program structure. From the WinFax PRO main screen, for example, you can open the Receive Log dialog box, or you can open the Send Log dialog box. You can open only one at a time, however. And if you use the drag-and-drop feature rather than keyboard commands to drag names, for example, from a phone book to a recipient list, the dragging is only from one list box to another in the same dialog box.

UltraFAX uses a desktop metaphor similar to that of Xerox Corp.'s PaperWorks (except that UltraFAX also lets you send faxes by keyboard command). The default for UltraFAX is to open lots of overlapping Windows—Phone List, In Box, Out Box, Document Storage List, and Cover Pages List. If you drag and drop, you have to drag items from one window to another window or to an icon.

This disorganized desktop, with its clutter of open windows, can be a problem if you prefer to work in a linear, logical fashion. It can be particularly troublesome if the window you're trying to drag to or from is hidden behind another window. This is clearly a case where personal preferences rule.

Given the prerelease status of both fax software packages as tested, it's impossible to draw definitive conclusions about their worth. Assuming the release versions live up to their prerelease promise, however, it's clear that each of these, in its own way, raises the ante for competing in the fax software arena. □

UltraFAX, Version 1.0 *ZSoft Corp., 450 Franklin Rd., Mariette, GA 30067; 800-444-4780, 404-428-0008; fax, 404-427-1150. List price: $119.*
Circle 489 on reader service card

WinFax PRO, Version 3.0 *Delrina Technology Inc., 6830 Via Del Oro, #240, San Jose, CA 95119-1353; 800-268-6082, 408-363-2345; fax, 408-363-2340. List price: $149 ($129 until January 1, 1993).*
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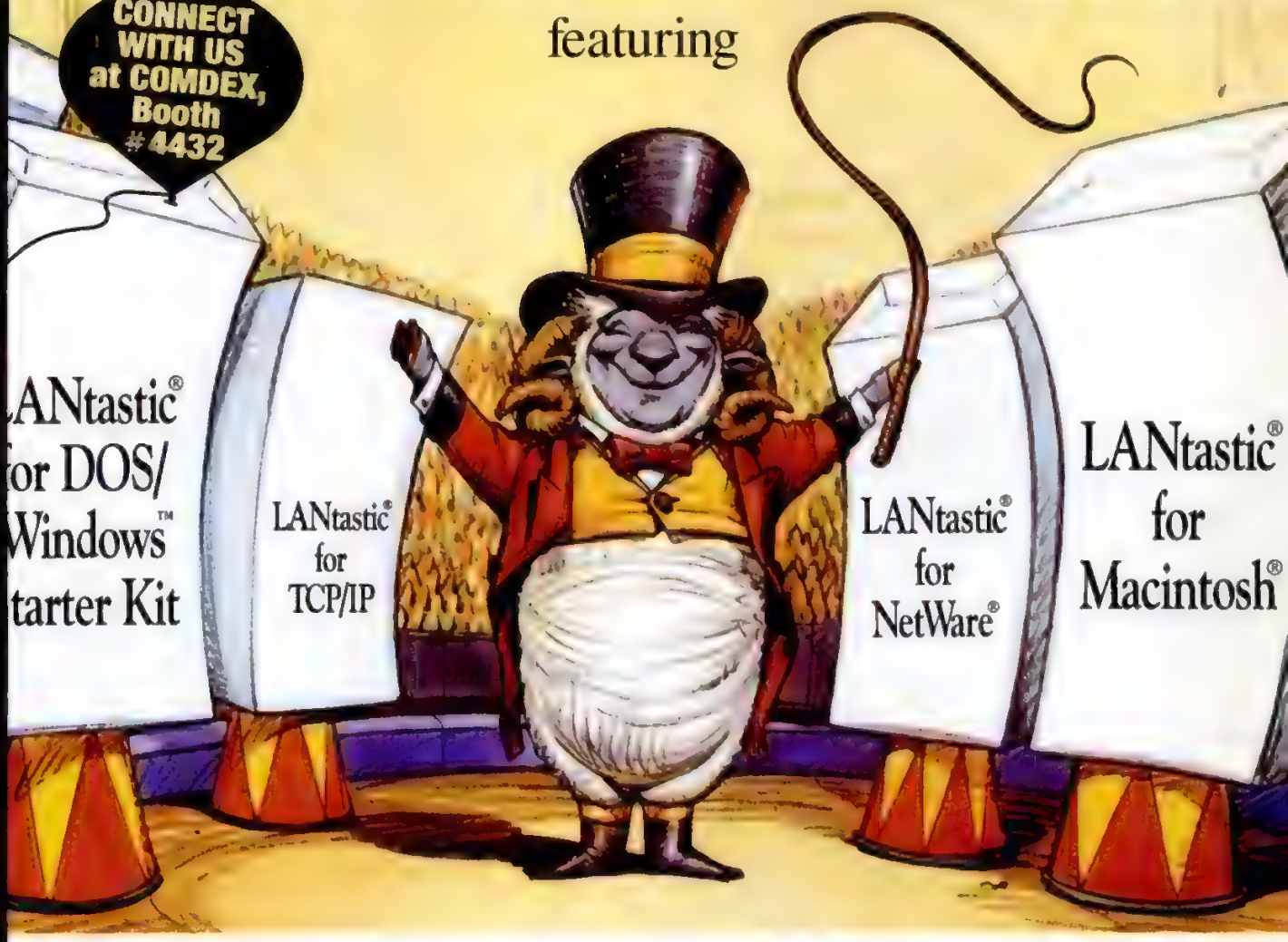

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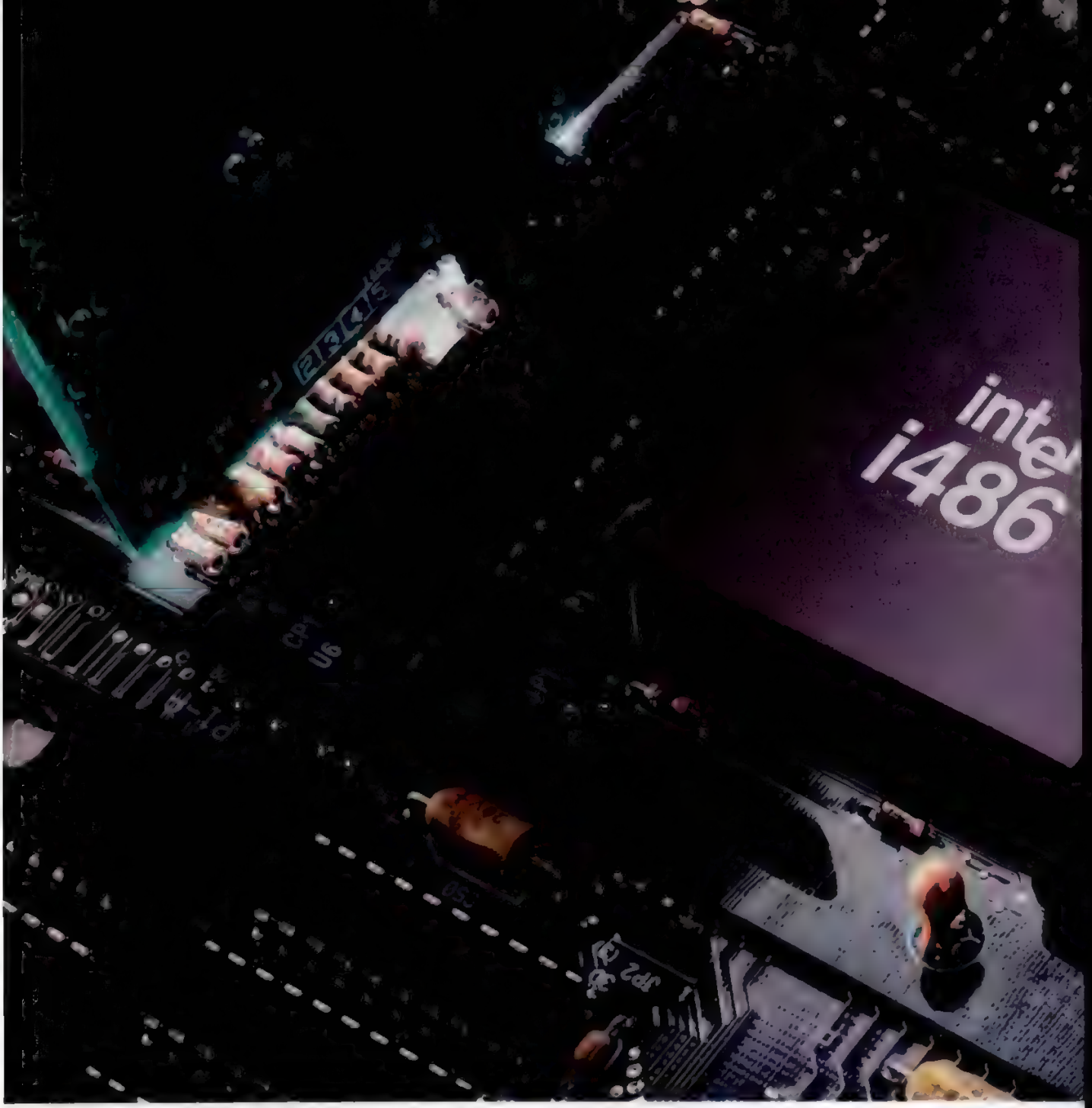

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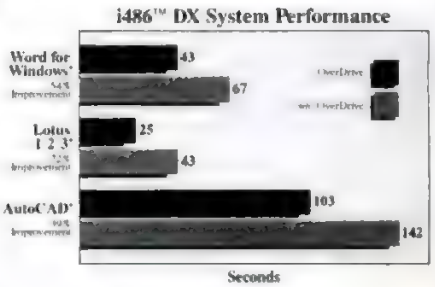

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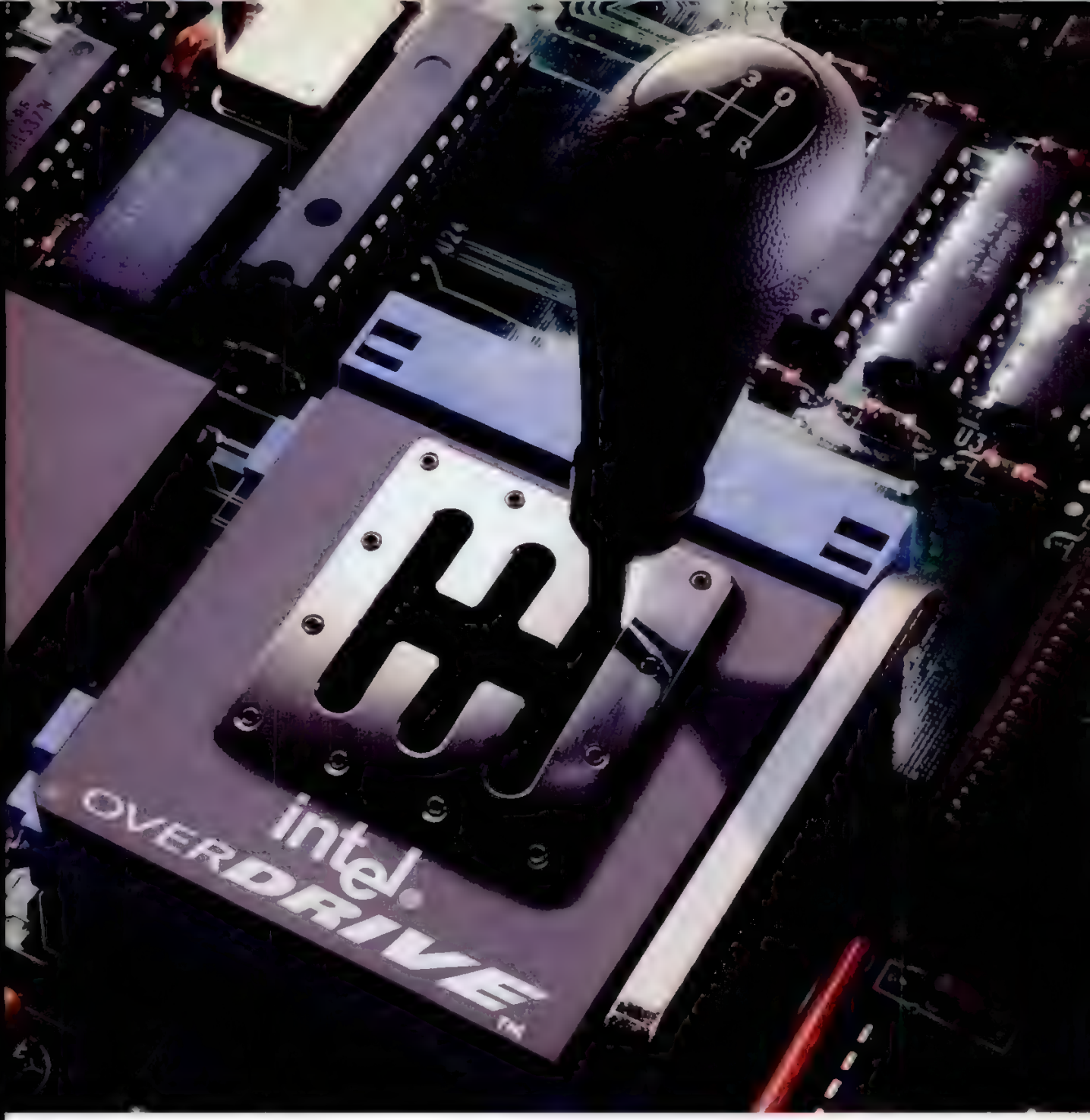
†In cases where there is no OverDrive socket, Intel recommends installation by a qualified technician



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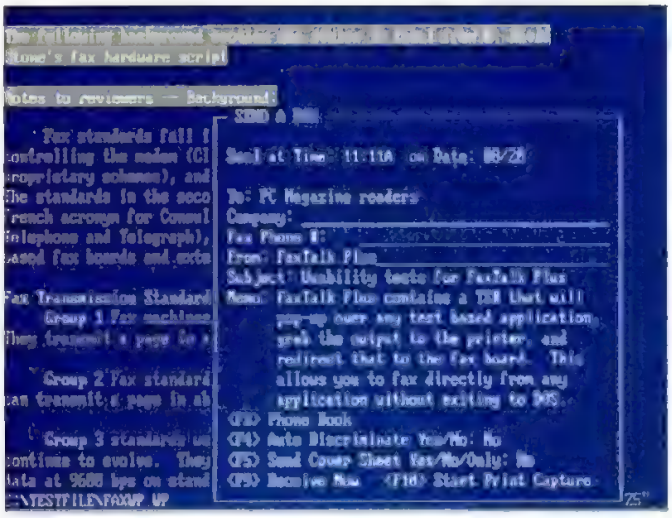


The FaxTalk Plus TSR can "grab" the output from text-based applications such as WordPerfect 5.1 and send the output to a fax machine.

fax solution that is easily learned, flexible, and powerful. Ineffective fax management remains its biggest drawback. Aside from this, FaxTalk Plus is almost ideal for both the novice and the advanced user.

Fremont Communications Co.

The Fax Window

BY EDWARD J. BENACK

The Fax Window, Version 3.0, the $119 offering from Fremont Communications Co. (Frecom), boasts some useful, even unique features, but its lack of other basic functions makes it a competitor for only low-end Microsoft Windows fax packages.

The Fax Window (TFW) carries one of the higher price tags among the dedicated fax products reviewed here, but it overlooks features that fax users have come to expect and desire. There is no scanner support, Multiple Document Interface (MDI), or OCR (optical character recognition) capability. Editing and archiving of faxes as well as importing and exporting of file formats are also absent. When hovering above a viewed fax, the cursor becomes a cross hair, leading the user to believe that it is a selection tool. Actually, the cursor exists for a future feature implementation.

TFW does not support CAS or Class 2 fax modems and may abort during installation. Worse yet, these facts are not documented in the manual, leaving no clue as to why the installation comes to an abrupt halt. In fact, the manual doesn't even mention that a fax modem is required.

A CLOSED WINDOW

Despite Frecom's claims of complete background send and receive features, it simply isn't so. During testing, we made 67 attempts to receive and send faxes in the background. Only three of those attempts were successful. In addition, even when TFW had the foreground, it had difficulty handshaking with a remote CAS (Communications Application Specification) fax modem.

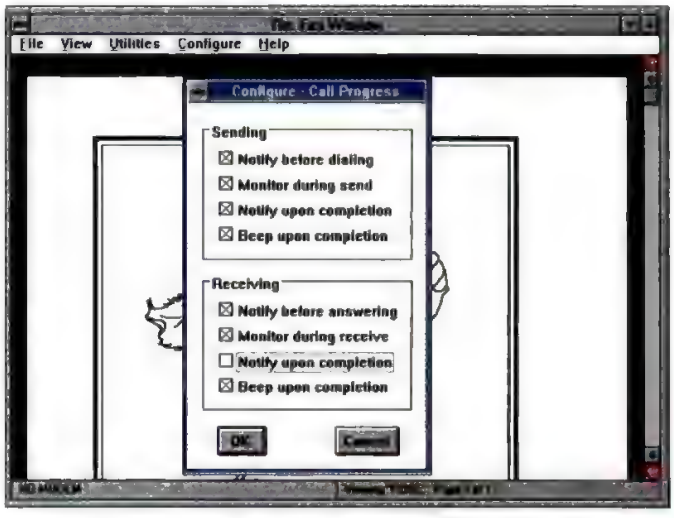
To its credit, TFW includes a very speedy fax driver that creates the fax image by printing from any Microsoft Windows application. Even with large graphics files, the conversion times were impressive.

NEW GROUND

TFW does venture into uncharted waters in two areas. First, it incorporates a fax merge capability, which aptly combines aspects of a print merge and a broadcast list. For example, a phone number can be embedded into a document via a field, and, instead of creating a print merge, TFW will create a fax merge.

The second innovative yet quirky feature is dubbed the "CommPort Manager." In theory, this TSR would automatically eliminate serial port contention when running two or more applications that control an I/O device. The first time it was tested, the CommPort Manager did correctly hand off the port to the Windows Terminal application. But after receiving a fax where TFW again took control of COM2, it would not relinquish control back to the Terminal. Frecom is now aware of the problem and says it will be corrected.

There is no on-line help, and because



The Fax Window provides many user-definable options for fax notification.

SUITABILITY TO TASK
The Fax Window

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	○	○
Receiving	●	●	○	○
Fax management	●	○	○	○
Printing	●	○	○	○

FACT FILE

The Fax Window, Version 3.0
Fremont Communications Co., 521 Charcot Ave., San Jose, CA 95131; 404-955-0555; fax, 404-955-0701

List price: $119.
Requires: 1MB RAM (2MB recommended), 2MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0 or later
In short: Fremont Communications Co.'s first attempt at generic fax software falls short in both features and robustness. Full background send and receive is only a reality if the foreground program is Solitaire.
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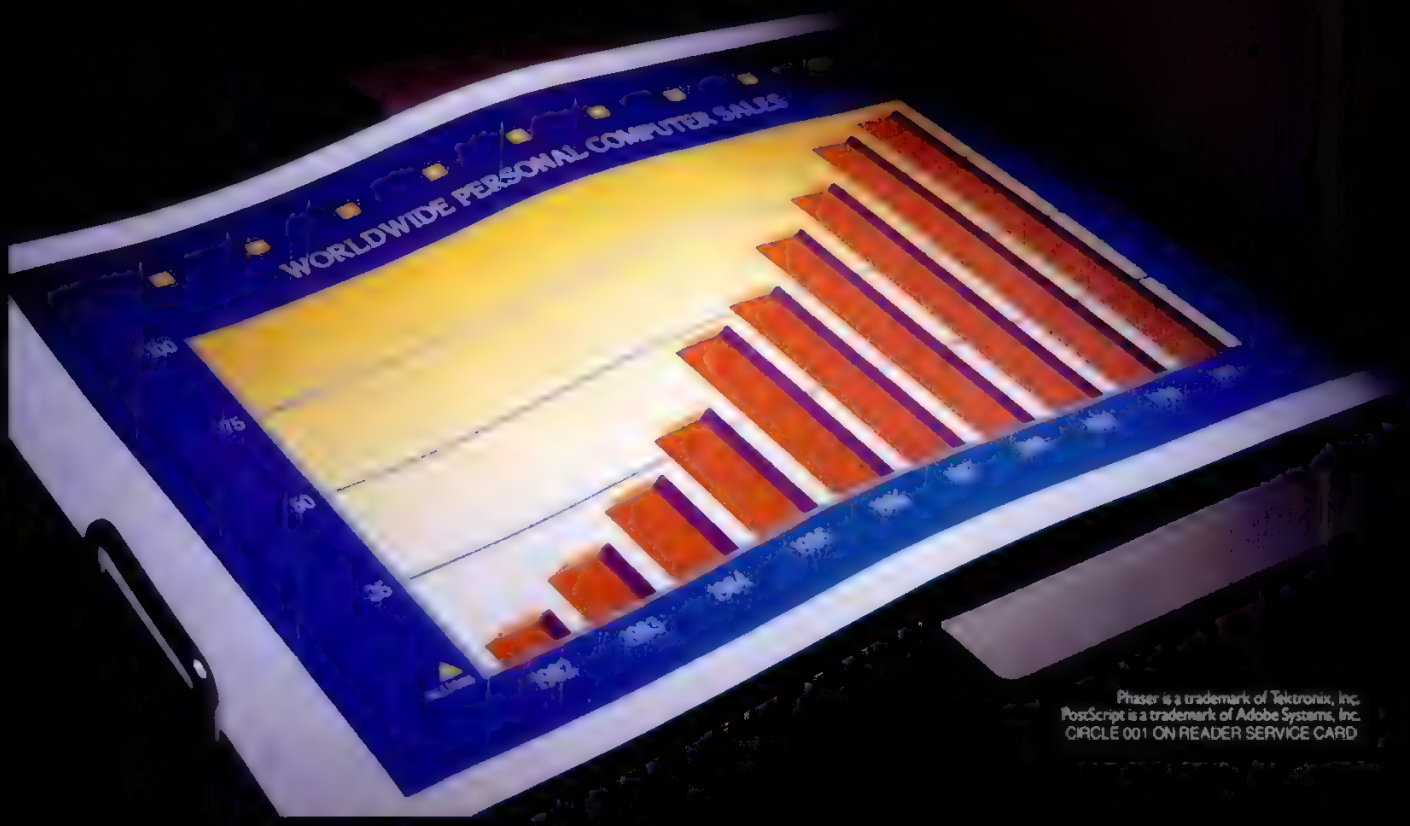
Tektronix
Computer Graphics



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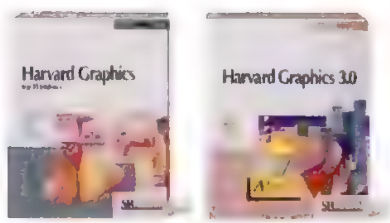

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Frecom was recently purchased by CXR Telecom Corp., phone support is a problem. CXR doesn't appear to be quite ready to assume the burden; we had problems getting any information out of tech support.

With so few redeeming qualities in The Fax Window, Version 3.0, it would be difficult to recommend the program for any user.

SoftKlone Inc.

Mirror III Fax

BY EDWARD J. BENACK

For those who believe in the viability of DOS applications and don't ascribe to a "dying DOS" theory, Mirror III Fax from SoftKlone should satisfy most faxing needs in the DOS arena. The $249 fax

software product is actually an industrial-strength data communications program with fax support. The Mirror III Fax packages's high-powered scripting language should make it an especially satisfying package for power users.

VERSATILITY

Mirror III has no provision for faxing formatted text. It can fax ASCII text and graphics in a variety of ways, however. As a TSR it can intercept the data stream from a printing document. This method is almost as simple as faxing under Microsoft Windows, but it only works in character-based applications that do not monopolize the keyboard interrupts. Mirror III's second method, which also works via TSR, faxes the currently displayed screen. Another method allows you to print to a disk and then translate the file from within the Mirror III application. Lastly, you can convert ASCII, Dr. Halo .CUT, and .PCX files for faxing. You may have to try more than one of Mirror III's

SUITABILITY TO TASK

Mirror III Fax

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	○	○
Receiving	●	●	○	○
Fax management	●	○	○	○
Printing	●	●	○	○

FACT FILE

Mirror III Fax, Version 2.5

SoftKlone Inc., 327 Office Plaza Dr., #100, Tallahassee, FL 32301; 800-634-8670, 904-878-8564; fax, 904-877-9763

List price: $249

Requires: 640K RAM, 1MB hard disk space, DOS 3.1 or later

In short: Mirror III Fax is a capable, intuitive integrated fax/data communications package. It offers a powerful scripting language to automate both data and fax communications

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SoftKlone's Mirror III Fax, Version 2.5, employs cascading menus to simplify the fax-sending process.

methods to get the fax sent, since it all depends on what application you use.

A single dialing directory holds fax, data, and voice numbers, but you can also choose to use separate dialing directories. To create a broadcast list, you simply tag entries. You set a delayed fax time either through the program interface or the DOS command line.

SMOOTH TRANSMISSION

Mirror III's fax transmission is handled completely as a background operation. There is no performance degradation in the foreground task, although the creation of the fax image is not as quick as with some Microsoft Windows fax products. Documents that are faxed appear true to the original; the quality is extremely sharp.

Unless you choose Manual Receive, Mirror III handles fax reception in the background as well. But the program gives no notification that a fax has been received. You must manually view the Receive Log regularly to keep tabs on incoming faxes.

FOLLOWING THE SCRIPT

Mirror III's real power stems from the PRISM scripting/programming language found in the data communications product. Heavy scripting with PRISM is not for the faint of heart, but it does allow interested users to modify the interface, add additional fax capability, or create separate applications. This works especially well in a corporate environment, where scripts can automate many manual faxing tasks.

Microsoft Windows users who want to take advantage of the scripting capabilities by running Mirror III in a DOS window should be aware that the PIF (program information file) provided by SoftKlone doesn't work. Fortunately, it is not difficult to create your own PIF. The vendor vows to correct this in future versions of Mirror III.

Overall, we can only recommend Mirror III for users who work almost entirely in character-based applications, have substantial data communication needs, and can squeeze the real power from the application's scripting language. Power users are much more likely to benefit from this product than less experienced users, who can get identical fax support in a bundled software package like Quick Link II.

WordPerfect Corp.

MTEZ Standard with ExpressFax

BY M. DAVID STONE

MTEZ Standard with ExpressFax, recently acquired by WordPerfect Corp., earns the "building block" award for DOS-based communications.

Various building-block modules offer standard communications ($50), additional emulations and file-transfer protocols ($19), a script language ($29), and faxing ($99, complete with the base program and the emulations and protocols package). For this review, we looked at the fax side of MTEZ Standard with ExpressFax—which proved easy to use and surprisingly unobtrusive in background operation.

Although MTEZ is meant as a one-stop–shopping solution for all your PC communications, you won't have to learn a new communications program to use ExpressFax. The fax features are in a standalone module that you can use without ever looking at the standard communications screen. But the fax module does call on the MTEZ.EXE communication module, so you must have the program on your disk.

SETTING UP

The installation routine is simple. The first time you load the fax module, the program takes you to a configuration screen where you can set user preferences such as resolution (normal or fine) and whether to include a signature or letterhead graphics files.

Somewhat confusingly, the manual and setup screens refer to CAS, while the program supports only Class 1 fax modems (or Class 2 in another version). According to WordPerfect, the CAS setup refers to the background fax manager. The manager works with communication software designed for CAS modems, but it lets you use those programs with Class 1 (or Class 2) modems—a potentially useful feature if you have any comm software with CAS support.

BASIC CHOICES

MTEZ's main screen displays nine commands on the left side that can be invoked via the mouse or keyboard, and current status on the right.

There are several ways to send faxes: File Conversion lets you convert ASCII, .DCX, .PCX, or TIFF files, or files printed to disk (with an Epson FX driver), to the program's fax format. Send Fax lets you designate one or more files to send, starting with any of these formats or an already converted file. ExpressFax a Note lets you type a fax in the program's primitive text editor, send it, and option-

SUITABILITY TO TASK

MTEZ Standard with ExpressFax

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	○	○
Receiving	●	●	○	○
Fax management	●	○	○	○
Printing	●	○	○	○

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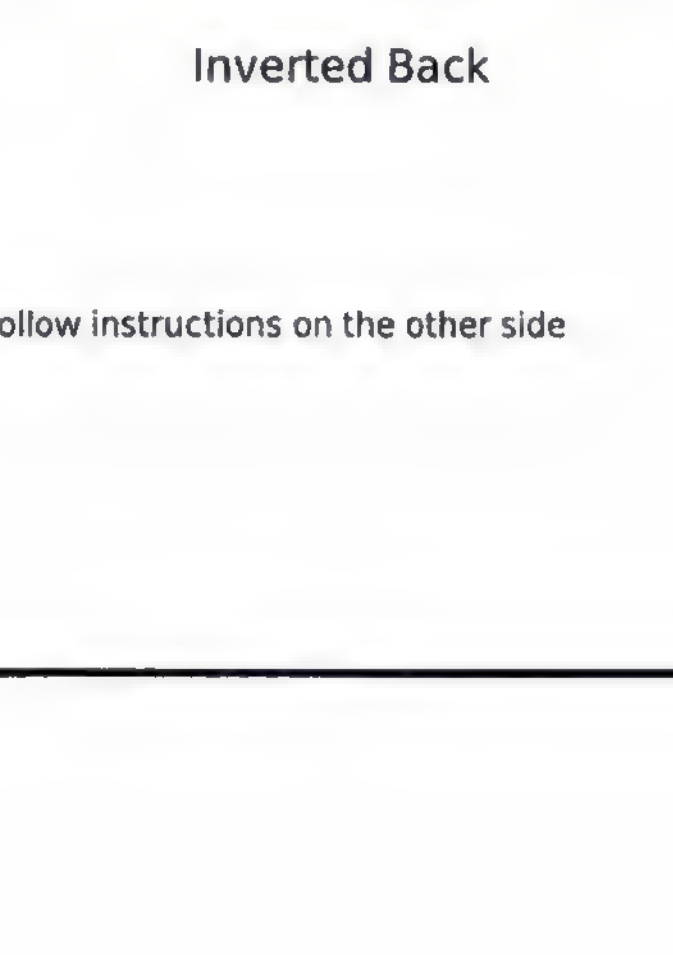


Inverted Back

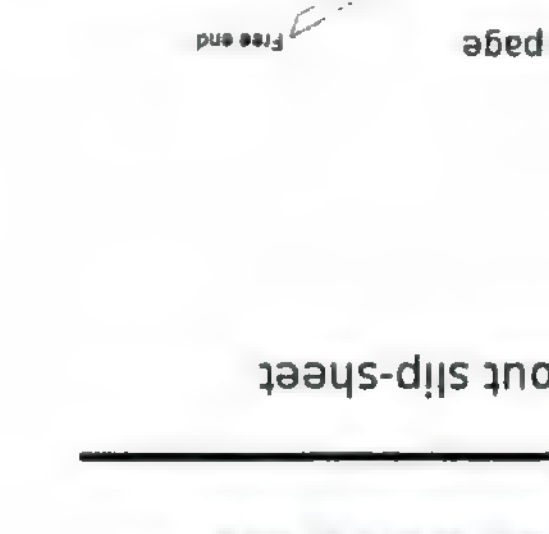
1. Follow instructions on the other side

Back

1. Follow instructions on the other side

Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

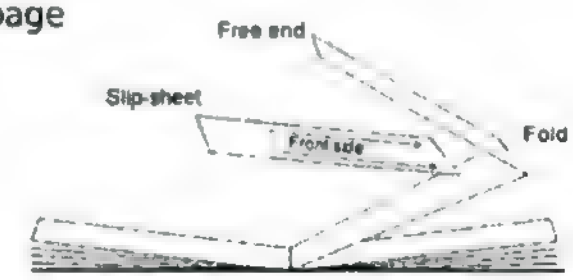


Folded edge of the page

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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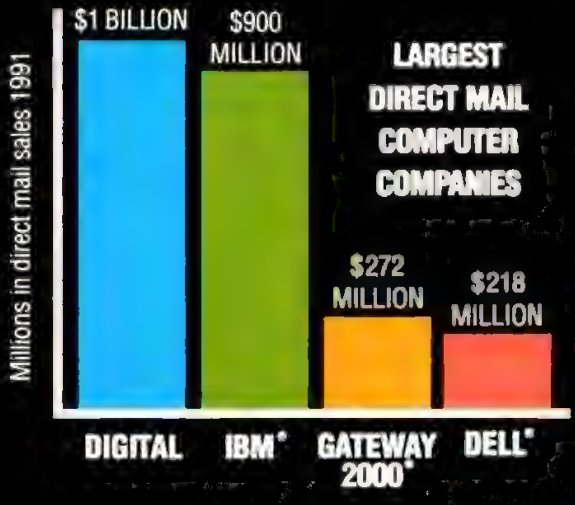

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The Outlook on Professional Computing
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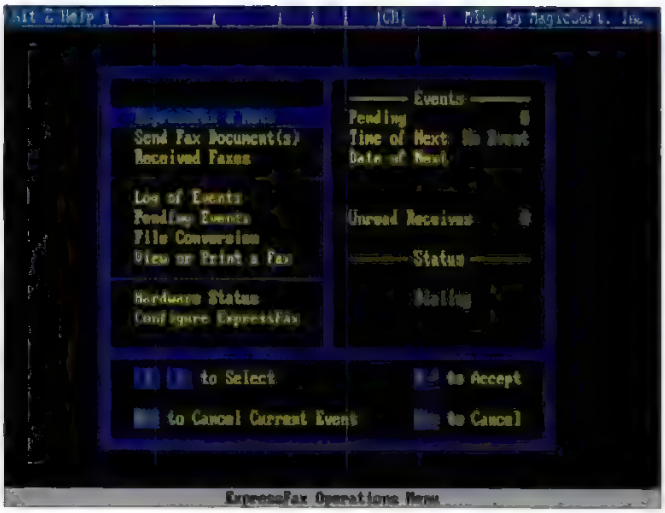


The MTEZ main screen offers nine main menu commands on the left side, divided into three groups. The right side shows status information.

ally save the note for future use. You can also send a fax by loading and activating the print-capture TSR and then printing from any DOS program with an Epson printer driver.

The phone book is limited to a maximum of 200 entries and eight groups. You can assign each entry to one or more groups, but you can only designate one entry or one group for any given fax. The program can also read a list of names and numbers from an ASCII file created with your favorite text editor. There is no scanner support.

To see incoming faxes, you choose Received Faxes from the main menu, then select an item from the log to print or view. There is no graphics editor, OCR (optical character recognition), or compression feature. Fax management consists of merely deleting or moving fax files. Printing support includes Canon BJ-10e, Epson, HP DeskJet and LaserJet, IBM, and Panasonic KX-P printers. Support for Adobe PostScript is absent.

FACT FILE

MTEZ Standard with ExpressFax

WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; 800-451-5151, 801-225-5000; fax, 801-222-5077

List price: $99
Requires: 256K RAM, 1.4MB hard disk space, DOS 3.0 or later
In short: MTEZ Standard with ExpressFax offers unobtrusive background faxing, a simple menu structure, and the ability to capture print output from DOS programs and redirect it as a fax

541 ON READER SERVICE CARD

DEEP BACKGROUND

As mentioned before, ExpressFax is strong on background operation. Whether sending or receiving, you can keep working on another task and not even notice it. Combined with a simple menu structure, this makes MTEZ a good choice if you work primarily in DOS and don't need fax management or editing features. Note, though, that by the time you read this, ExpressFax may have changed somewhat. But at this writing, WordPerfect was not prepared to discuss its plans.

Xerox Corp.

PaperWorks

BY M. DAVID STONE

Make no mistake: PaperWorks, from Xerox Corp., is no mere copy of someone else's fax program. Quite the contrary, this $249.95 Microsoft Windows package is both innovative and idiosyncratic. It includes such state-of-the-art features as designating fax files and recipients with drag-and-drop, and it offers the unusual ability to accept commands from paper-based forms faxed to your system. Alas, the program drops the ball on basic functionality. In particular, it is so mouse-centered that you cannot use the keyboard to send a fax.

PaperWorks uses a desktop metaphor similar to that of the Macintosh (but originally developed by Xerox, after all). When you first start the program, you'll find five icons on an otherwise empty desktop: DOS Files, Recipients, Doc Index, In Basket, and Action Tray.

Preparing a fax is a matter of traipsing from icon to icon. Before you can send a fax, you need to define one or more recipients by choosing New on the menu bar, then Recipient, and filling in a dialog box. Defining potential documents to fax is trickier. First, you have to open the DOS Files and Doc Index windows by clicking on the icons. Then you add a file to the index by clicking on the name in the DOS Files window, dragging it to one of the category names in the Doc Index window, and dropping it. (Alternatively, you can open a window for the category and drag the file to the category window.)

OUT THE DOOR—ER, WINDOW

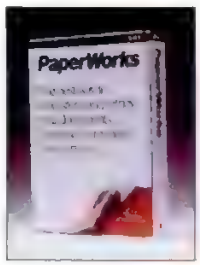
To actually send a fax, you open the Recipient window and (usually) a specific Recipient list window. Then you drag one or more document names from the Doc Index to the Action Tray (as icon or open window), and one or more names from the Recipient list to the Action Tray. (Alternatively, you drag a recipient list if you want to send to everyone on the list.) To send, you click the Send Fax button.

SUITABILITY TO TASK
PaperWorks

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	○	○
Receiving	●	●	○	○
Fax management	●	●	●	○
Printing	●	○	○	○

To see received faxes, you click on the In Basket icon, then on the entry you want to view. You can zoom and rotate the fax to read it on-screen, or print it by dragging the name to the Action Tray and clicking on the print button.

Fax management is PaperWorks' strong point. Fax files are automatically compressed when received. You can keep track of files by placing them in any Doc Index category you care to create, and you can archive faxes to floppy disk in .PCX format.



AN ALTERNATIVE DRIVER

Unlike most Windows fax programs, PaperWorks does not install as a print driver. Instead, it faxes ASCII, .BMP, EPS, .PCX, and PostScript print files directly from disk.

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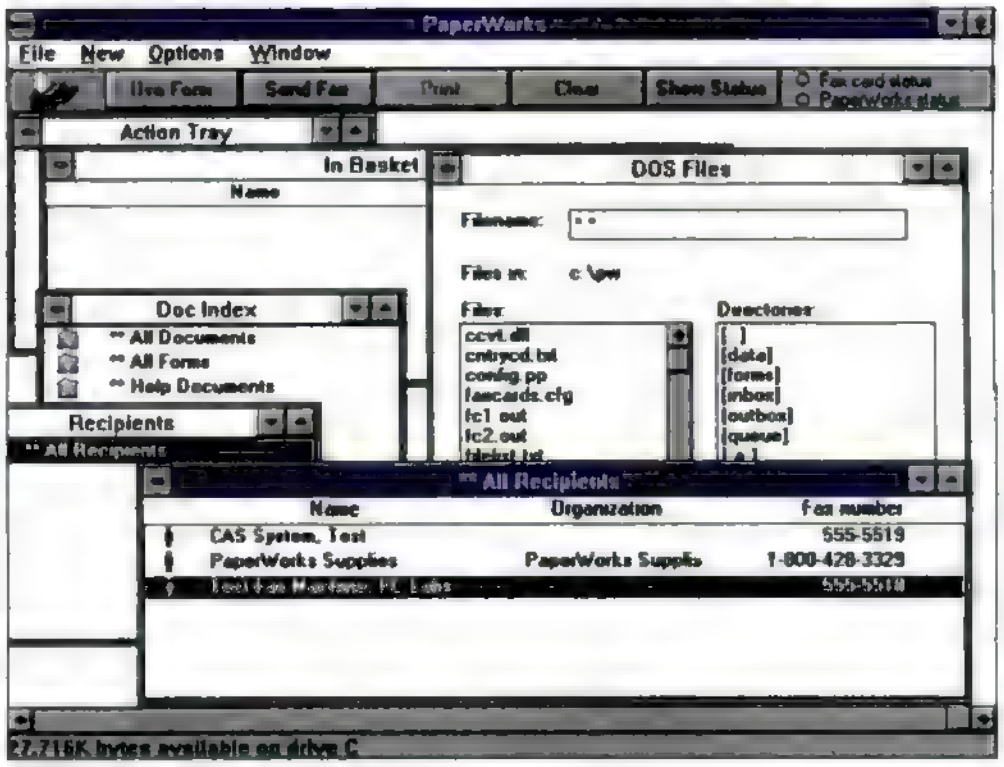

PaperWorks"desktop" can quickly get covered with open windows. Notice the Action Tray in the upper left corner, almost covered by the In Basket.

In addition, it can call up Microsoft Excel (2.1 and above), Microsoft Word for Windows (1.1 or above), and WordPerfect for DOS 5.1, instruct the program to print with a PostScript driver, and then intercept the output.

Interpreting PostScript is time consuming, however. PaperWorks took almost 17 minutes to convert PC Magazine Labs' test image when printed from Word for Windows. Worse, conversion has an obvious—and annoying—effect on foreground operations. When actually sending or receiving, the background operation is less noticeable.

AND MUCH, MUCH MORE

The program has no scanner support or standard OCR (optical character recognition) features. But it does feature an unusual OCR-based command interface.

Briefly, the program lets you create and print forms that you can then fill in and fax to your system, with instructions to fax documents elsewhere. This function is similar to that of a fax-back bulletin board, which responds to choices that callers make using the numeric keypad on a phone. (For more details, see the sidebar "Extending the Fax.")

In its current incarnation, PaperWorks is best appreciated as a work in progress—a first attempt that Xerox promises will be much improved in future versions. By the time you read this, Version 1.1 should be available with Class 2 fax modem support, plus the ability to print to the fax driver and create customized cover sheets. For the moment, however, idiosyncrasies far outweigh innovation, and PaperWorks is less a useful program than a collection of interesting ideas.

Unlike most Windows fax programs, PaperWorks doesn't install as a print driver. Instead, it faxes print files directly from disk.

FACT FILE

PaperWorks, Version 1.01

Xerox Corp., 3400 Hillview Ave., Palo Alto, CA 94304; 800-432-9329, 510-651-7299; fax, 800-428-3329, 510-651-2462

List price: $249.95.

Requires: 4MB RAM, 20MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0 or later running in 386 Enhanced mode

In short: PaperWorks is strong on whiz-bang features, but it lacks important functionality, including a keyboard interface. Later versions may prove more usable.

542

Pacific Image Communications Inc.

SuperFax for Windows

BY EDWARD J. BENACK

The rush may be on to publish more comprehensive and feature-filled fax software, but Pacific Image Communications has managed to sidestep this trend with their $99 product, SuperFax for Win-

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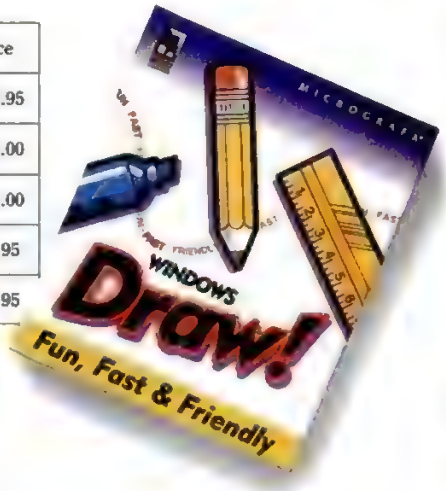

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CIRCLE 157 ON READER SERVICE CARD

dows, Version 5.0. Unfortunately, the lack of bells and whistles in this program—OCR and fax annotating and editing, for example—doesn't make SuperFax for Windows an easy-to-use or less complicated product.

Pacific Image Communications Inc. has taken such liberties with the Microsoft Windows interface that more experienced users are sure to be confused. Common Windows dialog boxes are missing, and menus offer such highly unorthodox choices as a Save As option under the Edit menu. The result is that SuperFax for Windows hardly seems suited to compete with other Microsoft Windows–based facsimile software packages.

Installation is fairly straightforward, but it has some puzzling twists. For example, though SuperFax for Windows correctly identifies the type of fax modem, it still prompts the user to supply the port location (COM1, COM2, and so forth). Currently, SuperFax supports only Class 1 and Class 2 fax modems, with no provisions for CAS modems.

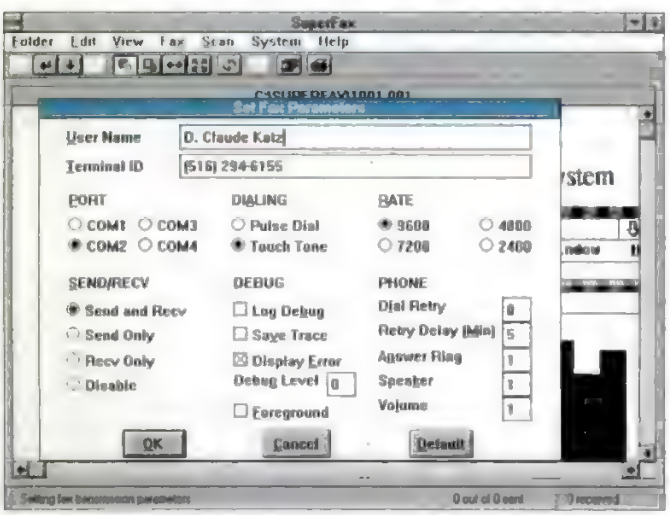
DIFFERENT STROKES

SuperFax for Windows provides two standard methods for sending faxes: You can fax by choosing Print from within any application and selecting the fax modem as the output device, or you can print to a file and choose to schedule to fax it at a later date from within SuperFax for Windows.

SuperFax for Windows also features FastFax. It lets you fax a message to someone by simply typing a few words in a dialog box, entering a fax number, and hitting the OK button. You can even save the text for later use in another fax message.

SuperFax for Windows takes such liberties with the Windows interface that experienced users are sure to be confused.

Furthermore, by printing to files and adding the documents to a "working folder," you can send documents from multiple sources in one operation. These folders can be sent only from inside the SuperFax for Windows application, though, and there are some irritating restrictions on addressing the transmissions. For instance, you must preenter all addresses if you want them available to be selected from the pick list for a fax broadcast later.



SuperFax for Windows, from Pacific Image Communications, allows users to configure the working environment easily.

To avoid confusion, SuperFax should already be loaded when you fax from an application. Otherwise, nothing appears to happen when you try to fax (doubtlessly prompting you to make repeated attempts). With each attempt, however, the driver prints your fax to a file. When you next launch SuperFax, it then dials out and transmits every attempted transmission. Overall, faxing from within an application is just too slow—in some cases taking more than three times as long as other Microsoft Windows fax products such as Fremont Communications Co.'s The Fax Window.

One bit of bright news: SuperFax transmits in the background without disturbing your work. The bad news: It frequently times out when receiving faxes in the background.

COMING AND GOING

Incoming and outgoing faxes are assigned filenames in a sequential numbering scheme. There is no way to attach more descriptive filenames. Nor is it possible to resubmit a successfully transmitted fax from the fax log or to resend it to a different party.

SUITABILITY TO TASK
SuperFax for Windows

	POOR	FAIR	GOOD	EXCELLENT
Sending	●	●	○	○
Receiving	●	●	○	○
Fax management	●	○	○	○
Printing	●	●	○	○

SuperFax renders extremely accurate faxes using TrueType fonts in Windows 3.1. When printer-based fonts were specified, though, Courier was often substituted.

Though SuperFax for Windows does have some strong points, its limitations detract from its overall usefulness. With the abundance of new and improved fax packages available today, we see little reason to buy SuperFax for Windows in its current form. □

FACT FILE

SuperFax for Windows, Version 5.0

Pacific Image Communications Inc., 1111 South Arroyo Pkwy., #430, Pasadena, CA 91105; 818-441-0104; fax, 818-441-2370

List price: $99
Requires: 2MB RAM, 2MB hard disk space, DOS 3.1 or later, Microsoft Windows 3.0 or later
In short: SuperFax for Windows lacks too many now-commonplace features to be considered seriously. Its performance is sluggish and its quality of output is only average

543 ON READER SERVICE CARD

Negotiating the Fax Modem Jungle

Fax modems are surging in popularity, but the market has some maturing to do.

Fax modem sales are booming. Industry analysts predict that sales of the hybrid devices will triple this year and that fax modems will outsell fax machines for the first time. It all sounds promising: inexpensive, standardized hardware bundled with software that is getting better all the time. Unfortunately, the story is not that simple.

Users want fax hardware and software that work together. They want standards they can count on. They want performance and reliability. They want ease of use. Unfortunately, fax modems are on the "bleeding edge" of a technology that isn't completely mature. You can get a fax modem that will work for you, but you will have to pick your way gingerly through such thorny issues as performance, changing technology, adherence to standards, and software and hardware compatibility.

During our tests of fax modems, we discovered that some modems claim to comply with the existing fax standards but don't really, that some modems claim to meet standards that don't yet exist, and that some fax modems simply don't work as they should.

In polling vendors' support forums on CompuServe and listening to our readers, we were not surprised to learn that users are frustrated, confused, and angry. According to them, it's a jungle out there.

NO CLASS ACT

If you already have a fax modem, it's most likely a Class 1 modem. That's partly because the Class 1 standard, which expects your fax software to do most of the work, is a dominant modem specification today. It's also because Class 1 modem chip sets are inexpensive, small, and easy to add to the existing circuitry of a data modem.

Class 1 is an approved standard of the Telecommunications Industry Association. But that standard is subject to varying interpretations, and implementations therefore differ from one vendor to the next. This means your Class 1 modem may or may not work with software that is compatible with Class 1 modems.

The Class 1 standard says, for example, that software flow control is mandatory. Most of the modems we tested default to software control, so they work out of the box with Class 1 software. The U.S. Robotics modems do not; they default to hardware flow control. Some companies believe that customers who use the modems mainly for data transmission are better served if the modems default to hardware control. Hardware control is a necessary component of data compression, making hardware flow control more useful for high-speed communications.

Most modems support software and hardware flow control. Changing from one to the other is a matter of adding a sequence to the modem initialization string. Should users have to figure out why their hardware won't work with software that is supposed to be compatible with the Class 1 standard? We think not.

CLASS 2, WHERE ARE YOU?

Class 2 is not a standard—yet. It is only a recommendation that has not been approved by the standards committee. Depending on whom you talk to, Class 2 is hopelessly mired in committee politics, likely to be approved imminently, the greatest thing to happen to fax modem technology since the transistor, or a complete waste of time.

Our advice: Don't count on Class 2. If you do buy a Class 2 fax modem, be sure the software bundled with it meets your needs, since you may not be able to use popular, off-the-shelf software with the modem. Several fax software vendors claim their programs are already compatible with the proposed Class 2 standard,

by Rick Ayre

HIGHLIGHTS

Fax Modems

TWELVE EXTERNAL FAX MODEMS from seven vendors are reviewed here. Each includes bundled fax software and meets the Class 1 standard.

YOU'LL GET BETTER SPEED by purchasing a V.32bis fax modem. The price is a bit higher than with a V.32 product, but V.32bis gives you a data-signaling speed of 14.4 kilobits per second; the speed of a V.32 device is 9.6 Kbps. The V.17 standard permits 14.4-Kbps faxing.

THE FASTEST external modem for faxing graphics and text files was Intel's SatisFAXtion Modem 400/e.

THE LEAST EXPENSIVE V.32 fax modem we tested is the Zoom VFX V.32 at $399. The least expensive V.32bis fax modem is Supra Corp.'s SupraFAX Modem V.32bis at $439.95.

CREDIT-CARD-SIZE high-speed fax modems are hitting the market, starting with AT&T Paradyne's KeepInTouch Card. KeepInTouch fits into a portable computer's PCMCIA (Personal Computer Memory Card International Association) slot and transmits at 14.4 Kbps.

but these programs won't always work with every modem also claiming to meet this standard. We simply haven't been persuaded that the software and hardware vendors who have so much trouble working together on the Class 1 standard are going to do better with Class 2.

ALL THIS AND FAX, TOO

Few aspects of computing manage to generate as much confusion as asynchronous communications. Unfortunately, adding fax capability has only increased the confusion. Most modem manufacturers seem to be treating fax as a sideline to the real business of modems: data transfer. Instead of viewing fax capability as a variation on the Trojan horse that will get more modems into places they haven't been, they see it merely as a value-added feature. The thinking is: "all this and fax, too." The result is that the fax functions are not yet getting the kind of attention they deserve from vendors. For instance, Class 2 would benefit fax modem users, since it enables the devices to translate the file from an application's document format into fax format without making the software (and your computer's processor) do all the work. Why is it taking so long for modem vendors to ratify it?

Not all of the news is bad: Most of the modems we tested do work. The bundled software, which can be most kindly described as functional, will enable even the occasional user to send and receive faxes. What you don't get is ease of use, fax management, or the OCR capability that the best fax software packages offer.

Some good news: Most of the modems that we tested performed well as data modems. Clearly, you will not have to sacrifice data transmission rates to get a fax modem you'll be happy with.

We didn't pick an Editors' Choice for fax modems because we think the technology and compatibility issues are still unsettled. None of the reviewed products is free enough from the problems caused by these issues to merit the Editors' Choice designation. However, if you are willing to pay for the best and have room in your system for an internal modem, the Intel SatisFAXtion Modem 400 is likely to be the best choice. Not only did its coprocessor help it perform better than any other fax modem on most of our benchmark tests, the device worked well with the Editors' Choice fax software. We did not review the SatisFAXtion Modem 400, however, because it is not an external modem and therefore did not meet our review criteria. We include its test results for comparison. The external Intel SatisFAXtion Modem 400/e is a close second to the 400 on faxing. You get your money's worth in performance and reliability with either of these products.

If you're looking for a bargain, Zoom Telephonics' modems, the Zoom VFX V.32 and the Zoom VFX V.32bis, did very well on our tests and, at $399, the VFX V.32 has the lowest price of our tested units. Computer Peripherals' ViVa 14.4/FAX Modem also did well and costs only $50 more. Hayes's Optima 144 + FAX144 was a top performer as well but, at $519, costs significantly more than the Zoom Telephonics products.

Our Contributors: ANGELA GUNN is staff editor for *PC Magazine*'s applications development team. RICK AYRE is technical director of software testing for PC Magazine Labs. ERIC BERLIN is a frequent contributor to *PC Magazine*. TONY POMPILI is systems manager at Ziff-Davis Publishing Co.

Computer Peripherals Inc.

ViVa 14.4/FAX Modem

BY ANGELA GUNN

Computer Peripherals' ViVa 14.4/FAX Modem immediately attracts you by its appearance. A miniature tower with a faux-marble base and icons for status lights, the $449 product looks great on a desktop. And behind the pretty face is a modem that's reliable and easy to use. On our benchmark tests, it was one of the top performers at transferring files.

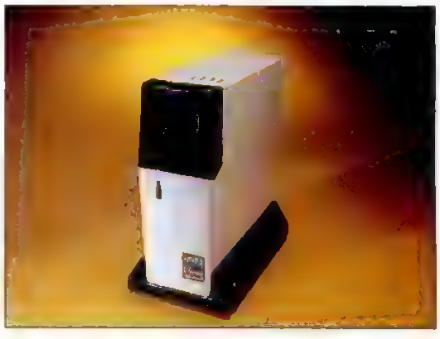
The ViVa 14.4/FAX Modem comes with Smith Microsystems' QuickLink II for DOS and Delrina Technology's WinFax Lite for Windows, but no serial cable. Once you add the cable, the modem is simple to install.

The ViVa features a remarkably small footprint without sacrificing any readability on its front-panel icons. Those icons are a bit precious (a rabbit as a 14.4-kilobit-per-second high-speed indicator, Mickey Mouse-like ears indicating that the modem is listening for a call), but users not familiar with the traditional two-letter LED labels that most modems use may find them refreshingly friendly.

The device's connector markings are clear, and, as with all modems reviewed here, you can control the loudness of the connecting signal only through software; there is no hardware volume control. The modem uses a Rockwell chip set.

The ViVa's data-transfer performance was excellent; it placed first on two of the five tests. The bundled fax software is basic and serviceable. The DOS program, QuickLink II, is also a communications program.

Computer Peripherals supplies good documentation that describes the modem specifically and backs it with a five-year warranty and toll-free support from 7:00 to noon and 1:00 to 4:00 Pacific time, Monday through Friday. A 24-hour BBS is also available.



If you need an external fax modem, you could do worse than the small-footprint ViVa. Behind the attractive exterior, you'll find a dependable performer.

ViVa 14.4/FAX Modem
Computer Peripherals Inc., 667 Rancho Conejo Blvd., Newbury Park, CA 91320; 800-854-7600, 805-499-5751; fax, 805-499-5742. List Price: $449.
Circle 468 on reader service card

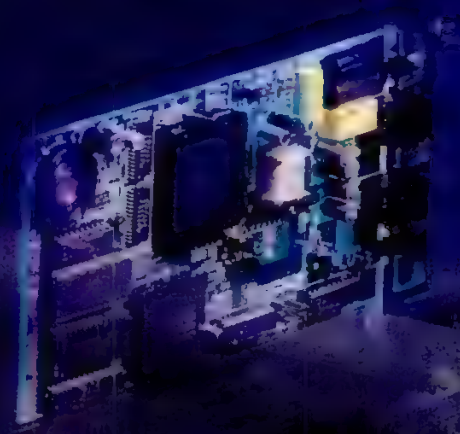
Hayes Microcomputer Products Inc.

Optima 96 + FAX96
Optima 144 + FAX144

BY ERIC BERLIN

Hayes's high-speed fax modems transmit data well, but Hayes's own fax software has some drawbacks. If you decide to buy either the Optima 96 + FAX96 or Optima 144 + FAX144, you'll need to replace the software.

Hayes's 9.6-kilobit-per-second Op-



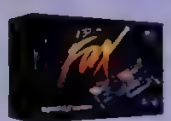
"Recommended."
Jerry Pournelle, Byte, July 1992

Inside Out

SupraFAXModem V32bis Internal
$349.95 Dos/Windows

SupraFAXModem V32bis External
$399.95 Stand Alone
$439.95 Dos/Windows

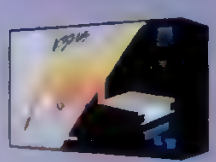
The Best Choice: SupraFAXModem



Inside or Out, now you can choose the hot-selling **SupraFAXModem** technology that best fits your computer. Either way, Supra can turn your PC into a communications powerhouse!

SupraFAXModems come in a wide range of models, from our budget-minded **SupraFAXModem** 24/96i to the fastest fax modem available: the **SupraFAXModem** V.32bis. Whichever model you choose, you will get Supra's proven technology and reputation for high-quality, reliable modems.

Supra modems are designed for novice and expert communicators alike. Whether you use DOS™, Windows™, or a Macintosh™, we [illegible] package for you — and our packages include everything you need. Plus our easy-to-follow Getting Started manuals will help you install your modem and start using it in just a few minutes! Imagine sending and receiving perfect faxes, exploring the world of on-line databases, or retrieving an important work file — all from the convenience of your desk. And advanced users will appreciate the error-correction and data-compression features that can save you money!



Supra Corporation

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[illegible]					
SupraFAXModem V.32	E	9600 S / R	9600	yes	38,400
[illegible]					
SupraFAXModem 24/96i	I	9600 S / 4800R	2400	w/ software	9600

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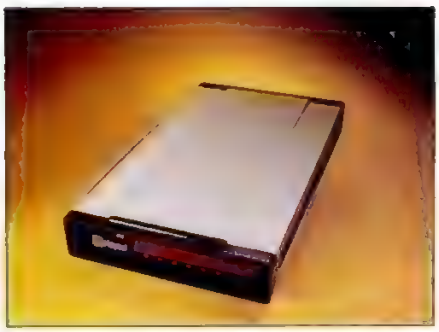

tima 96 + FAX96 sells for $419; the 14.4-Kbps Optima 144 + FAX144 costs $519. The modems come with DOS-based Smartcom EZ, Hayes's entry-level communications package, and Smartcom FAX, also a DOS program. Neither modem includes a serial cable.

Installation is simple. The Hayes fax modems have an average-size footprint and clearly visible status lights and markings. They use a modified version of AT&T's chip set. The performance of the modems was average or better throughout our tests; they were especially strong at uploading files.

The bundled software has some shortcomings. You cannot use Smartcom FAX with a mouse, and program functions are not assigned to function keys in a logical fashion. Selecting more than one file to transmit requires more button-pushing than necessary, and .PCX file conversions, even in normal resolution, take too long.

The packages include illustrated user guides, and Hayes' two-year warranty immediately extends to five years if you register within 90 days. Toll-free tech support lines are open from 8:00 to 6:00, Monday through Friday, eastern time, and BBS and CompuServe support are also available. The Hayes Optima modems are worth considering seriously if you're prepared to find software to match their abilities.

Optima 96 + FAX96
Optima 144 + FAX144
Hayes Microcomputer Products Inc., 5835 Peachtree Corners East, Norcross, GA 30092; 404-441-1617; fax, 404-449-0087. List Price: Optima 96 + FAX96, $419; Optima 144 + FAX144, $519.
Circle 469 on reader service card

Intel Corp.

SatisFAXtion Modem 400/e

BY ERIC BERLIN

The Intel SatisFAXtion Modem 400/e is for people who believe that the end justifies the means. The 14.4-kilobit-per-second, CAS- and Class 1-compatible fax modem delivers crisp fax output, but achieving that output means dealing with a few conflicts and, occasionally, outright aggravation.

The SatisFAXtion Modem 400/e offers more good news than bad, however.

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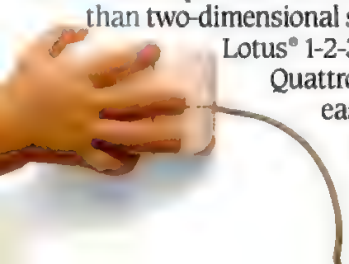
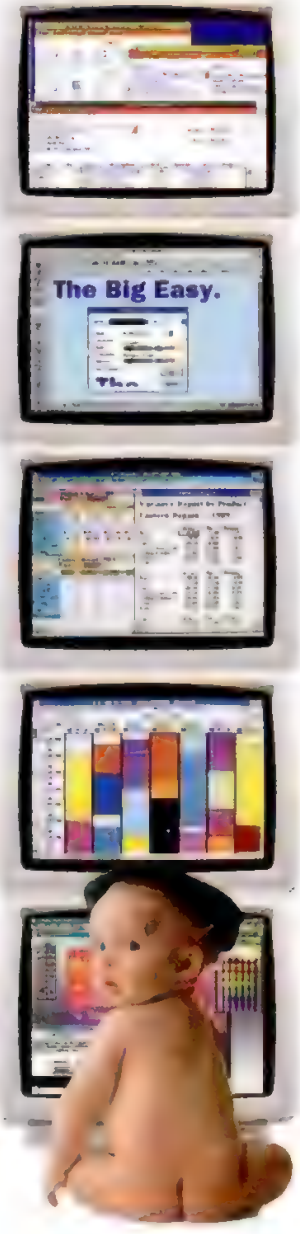
Crunching numbers is easy with this multi-dimensional spreadsheet. More advanced than two-dimensional spreadsheets like Lotus® 1-2-3®, Excel and Quattro® Pro, this is easier to learn and easier to use.





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CIRCLE 348 ON READER SERVICE CARD

FaxMaster...

Send.

FaxMaster™ lets you send faxes anywhere in the world – anytime. Transform any Windows-based system into "Fax Grand Central," in a way that will shame every overnight mail delivery service. Send faxes directly from your application without missing a beat – what you print is what you fax. Scan and fax paper documents – better than any fax machine – with one of *FaxMaster's* supported scanners. Put your best image forward by dropping in your company's logo and typeface – and send it anywhere, when rates are lowest.

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Who said it was better to send than receive? With *FaxMaster* you are alerted with each incoming fax. When you're ready to take a look, *FaxMaster* provides you with a "thumbnail" image of your incoming mail. Click on the *FaxMaster* Menu to view; and convert your fax into whatever format you happen to be running in your application at the time. In seconds, your incoming fax is up and running on your screen – ready for you to edit and save.

Most people think that sending and receiving faxes from a PC is just about the best thing to come along since sliced bread. But what they don't always notice is that once you get a fax, that's it. You read it and toss it in the waste basket.

That's why Caere® developed *FaxMaster* for Windows,™ the only fax software that goes beyond the "fax paper wad," by letting you change an ordinary fax into an intelligent one.

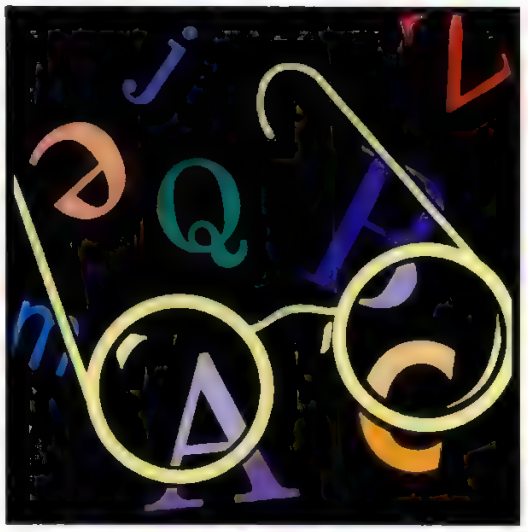
Other fax software gives you bitmapped faxes; or the ability to OCR only those faxes sent in "fine" mode. Only *FaxMaster*– which is based on the OCR industry standard, *OmniPage*® – has the ability to read both fine and standard-mode faxes. So you get the whole fax, and not just electronic alphabet soup.

With *FaxMaster* you can edit the faxes that you receive, or click on the "Export Text" icon and insert directly into your word processor. With *FaxMaster* you have the option to "compress" and save all of your faxes for later review.

The *only* complete fax solution.

OCR.

FaxMaster is the first fax software that lets you accurately scan (OCR) faxes electronically. Only *FaxMaster* is based on *OmniPage*, the industry standard, and only *FaxMaster* incorporates AnyFax™ technology, designed specifically to tackle poor quality fax OCR. *FaxMaster* lets you transform any fax into an intelligent one that you can move directly into your word processing document effortlessly – including low resolution faxes of newspaper articles and photocopied documents – regardless of font, font size or column format.



Compress.

There's no other fax software that lets you save faxes as economically and easily, without taking up all the available space on your hard disk. *FaxMaster* features Caere's proprietary SuperCompression™ technology, so the faxes you receive today will be available for you to view tomorrow. With compression rates as high as 15:1 over all other options, now you can afford to save those "off the record" faxes that might just pop back into your business at a later date.

Now you can send faxes in seconds anywhere in the world – at any time of the day. With *FaxMaster* you get all the convenience of a dedicated fax machine, with the interactivity of E-mail. And, you get the world's most complete fax software for only $249.

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CIRCLE 292 ON READER SERVICE CARD

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In Canada, please call: 1-800-553-3560.

U.S.Robotics Inc. 8100 N. McCormick Blvd. Skokie, Illinois 60076.

CIRCLE 231 ON READER SERVICE CARD

The $549 modem supports fax speeds up to 9.6 Kbps and provides PCL 5 font emulation. It comes with Intel's DOS-based SatisFAXtion software and the send-only Windows-based FAXability program, which allows you to direct printer output to a fax machine. Intel plans to bundle a send/receive version, FAXability Plus, with the modem by the time you read this. DCA's Crosstalk Communicator is also included. The package comes with a phone cable but does not include a serial cable.

Installing the device is simple. It has an average-size footprint for a desktop modem, and its status lights and markings are easy to see. The Modem 400/e uses a Rockwell chip set.

SatisFAXtion is particularly adept at sending and receiving faxes. It includes a pop-up utility called FaxPop for faxing or for sending output to PCL printers from within DOS applications. SatisFAXtion itself can fax out multiple ASCII and .PCX files to multiple parties, receive and print faxes, build a phone number list, and operate unattended.

But once you get the program up and running, quirks and minor aggravations spring up in the oddest places. A Crosstalk command, Alt-S, conflicts with the FaxPop hotkey, for example, and you can access cover-page logos only from a specific subdirectory. The most annoying quirk is that .PCX files faxed from Windows must be a multiple of 32 pixels wide (we never did accomplish this).

Intel supplies user and installation guides with the Modem 400/e. The company provides a three-year warranty, with no extensions. Technical support is available weekdays over a toll number from 7:00 to 5:00 Pacific time. Intel also offers a FaxBack service, a 24-hour BBS, and a CompuServe forum. The Intel SatisFAXtion Modem 400/e works well, particularly for faxing, and it offers versatile fax software.

SatisFAXtion Modem 400/e
Intel Corp., 5200 N.E. Elam Young Pkwy. CO3-11, Hillsboro, OR 97124; 800-538-3373, 503-629-7354; fax, 800-525-3019.
List Price: $549.
Circle 470 on reader service card

Practical Peripherals Inc.

Practical Modem 14400FXSA

BY TONY POMPILI

Practical Peripherals' Practical Modem (PM) 14400FXSA V.32bis fax modem brings an enhanced front-panel display to a market full of competing products that more closely resemble Hayes' modems.

With dimensions of 3 by 5 by 10 inches (HWD), this device is not a good choice if space is at a premium. It does have a number of strong points, however: You can set it up quickly, it works reliably with

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CIRCLE 150 ON READER SERVICE CARD

Performance Tests: Fax Modems

Today's modems can offer top-notch fax and data-transfer performance—but don't throw your fax machine out yet. The hardware and software we tested may be better than ever, but faxing with modems is still not a completely reliable process.

HOW WE TESTED

We ran all tests on Compaq Deskpro 386/33Ls running Compaq DOS 5.0 and Microsoft Windows 3.1. Each computer had 8MB of memory and a 340MB hard disk. For comparison, we include results for Intel's SatisFAXtion Modem 400, an internal CAS-compatible board whose coprocessor provides an extra performance boost.

We faxed files via the tested fax modem to a Xerox 7000 Group 3 fax machine that was enabled to receive at 9.6 kilobits per second. All modems were set to transmit faxes at 9.6 Kbps, regardless of whether they support the V.17 standard for 14.4-Kbps transmission. Most fax machines still run no higher than 9.6 Kbps.

We connected each fax modem to the Xerox fax machine using a Processing Telecomm Technologies (PTT) 5101 Central Office Simulator, modified by PTT to conform to the new Telecommunications Industry Association (TIA) specification. We wired two PTT 5151 Impairment Simulators in bidirectional-impairment mode and installed a PTT 5200 Cable Simulator with local-loop simulator cards. An HP 4947A Transmission Impairment Measurement Set (TIMS) ensured that the simulator worked as expected throughout the test series.

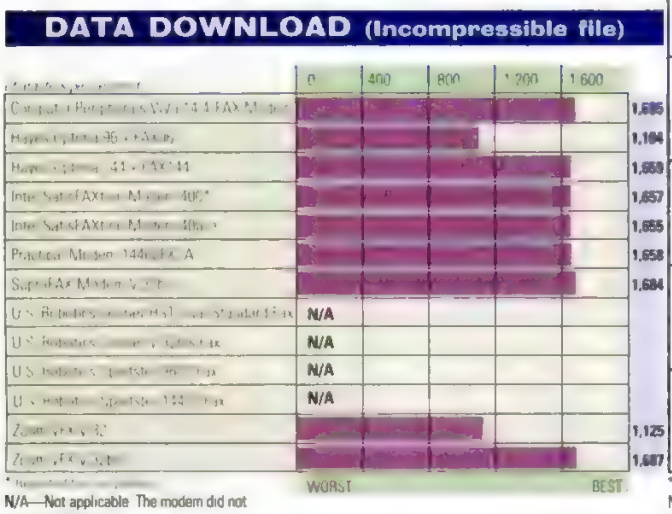
To test data-transfer performance, we sent and received files using Omen Technology's Professional YAM, Version 17.89, and ZD Labs' own GETZ program. The PC running Pro YAM sent the files using Zmodem to the PC running GETZ, which timed the transfer.

We connected each test modem through the Central Office Simulator to a Motorola Codex 3260 modem. We sent data in both directions using Zmodem as the transfer protocol, making a full-duplex connection to saturate the phone line.

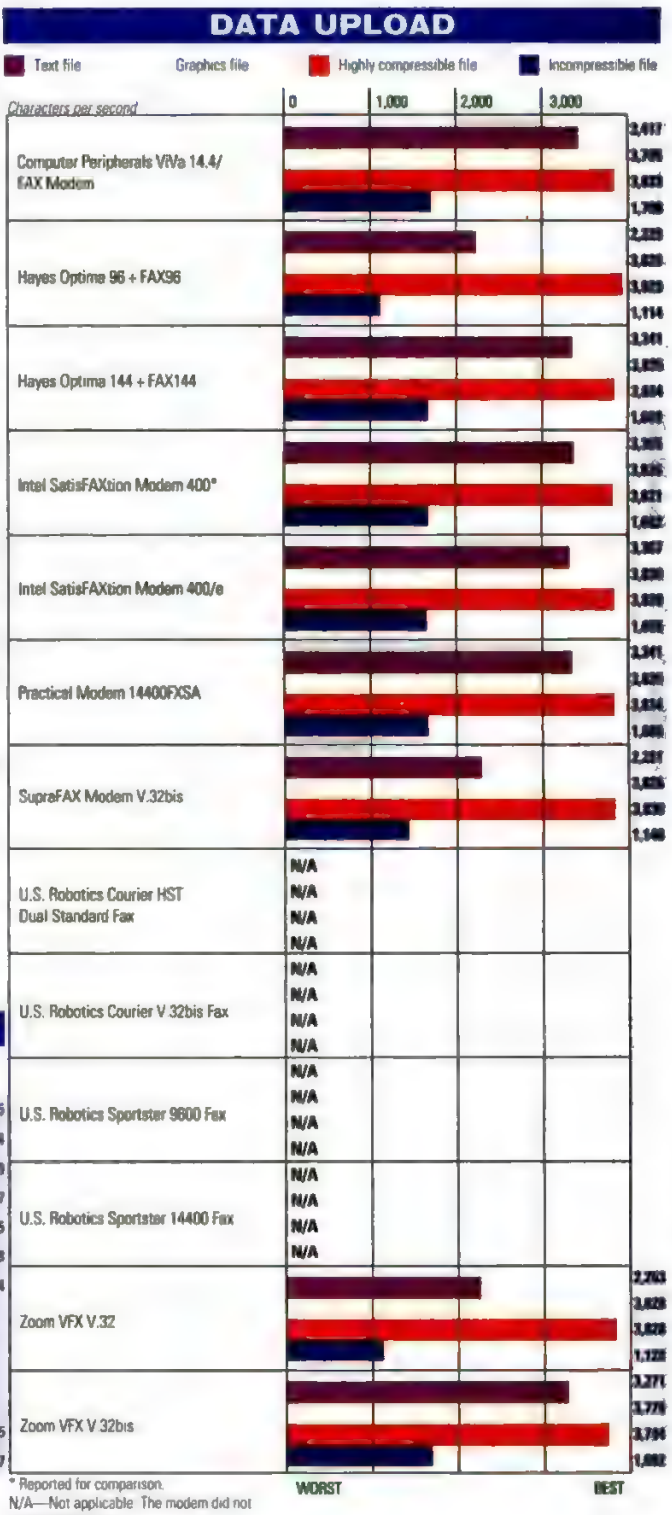
The **Data Download** test measures the products' data-transfer speed when receiving an incompressible file from a standard modem, using a long local-loop line.

The **Data Upload** tests measure the raw throughput of the modems when sending four files of varying levels of compressibility over the long local-loop line. Each file tests different features of the data modem, although all the tests stress the modem's data-pump integrity.

- The text file, a 469,341-byte file, contains a section of English text from a Ziff-



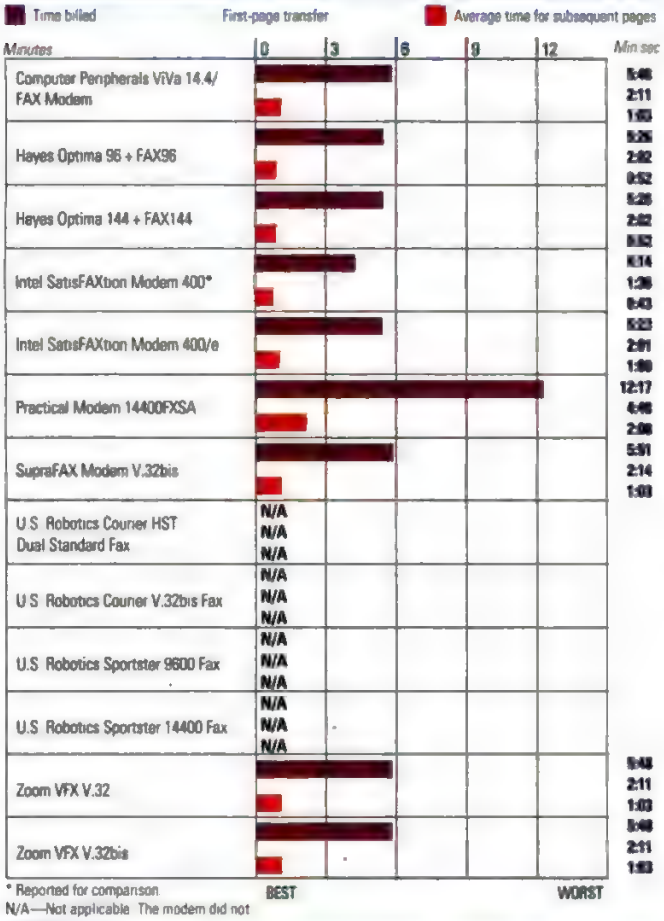
N/A—Not applicable. The modem did not complete this test.



* Reported for comparison.
N/A—Not applicable. The modem did not complete this test.

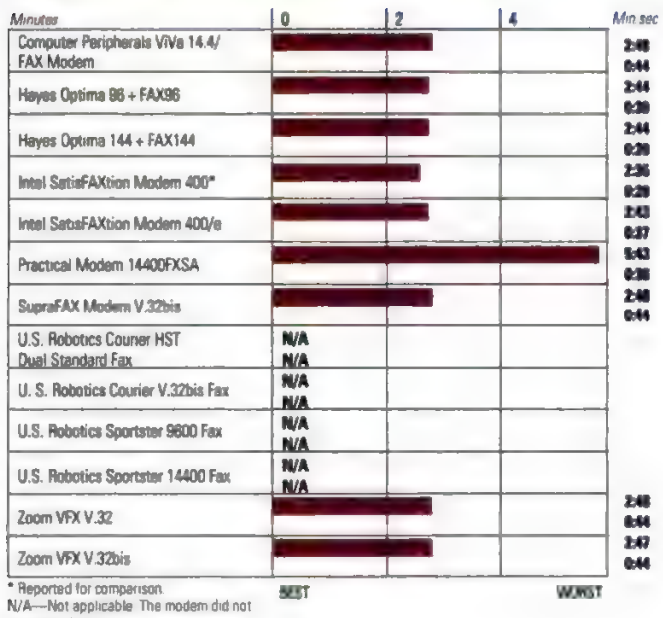
Performance Tests: Fax Modems

TEXT FILE FAX



* Reported for comparison
N/A—Not applicable. The modem did not complete this test

GRAPHICS FILE FAX



* Reported for comparison
N/A—Not applicable. The modem did not complete this test

Davis publication. It stresses the data pump and the V.42bis compression algorithm equally, demonstrating how the modem performs with actual text. Its compression ratio is 2.2:1.

- The graphics file, 663,063 bytes long, contains a line drawing saved as a TIFF file. It tests the modem's ability to shift from high compressibility to moderate compressibility. The compression ratio is 5.3:1, but in the first 100K the file compresses at 11:1.
- The highly compressible file is a repeated-text file, 609,289 bytes long, that stresses the modem's compression algorithm and interface with the computer's serial port. It repeats the string "THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789", which can be compressed at a ratio of 22:1.
- The incompressible file, 125,000 bytes long, represents a worst-case scenario. Because it can't be compressed, this file stresses the data pump most severely.

The **Text File Fax** test uses Delrina Technology's popular WinFax Pro 2.0 to fax out a five-page document created in Microsoft Word for Windows, Version 2.0a. We faxed the file three times and averaged the results. We report the total amount of time for which you would be billed, the time it took to transfer the fax's first page, and the average time for transferring each of the remaining four pages.

The **Graphics File Fax** test uses WinFax Pro, Version 2.0, to fax out a graphics file created in CorelDRAW, Version 3.0. We faxed the file three times and averaged the results. We report the total amount of time for which you would be billed and the time it took to transfer the single page containing the graphics image.

WHAT THE FAX RESULTS MEAN

Two factors to consider before purchasing a fax modem are the amount of time your PC will be tied up transmitting or receiving data and the cost of the call.

The amount of time it takes to regain control of your PC depends in part on the length of the file. All fax modems take longer to transmit a first page, because of the handshaking that initially occurs between the two modems. Performance over the remaining pages becomes fairly consistent. To help you project how long it would take to fax documents of varying lengths, we've provided the average transmit time for each page after the first one in our test. Since there was only one page for the graphics file, we don't provide an average connect time.

The billing time is the length of the phone call minus the time it takes to establish the connection with the fax machine. Practical Peripherals' Practical Modem 14400FXSA had the longest billing time. Practical Peripherals and Delrina Technology provide a new driver for WinFax that may fix this problem, but because of time constraints and because we wanted to test the modems only in their default state for generic Class 1 operation, we did not test the modem with the new driver. Similarly, we do not have fax results for the U.S. Robotics modems because they require a special initialization string to enable software flow control for Class 1 faxing.

WHAT THE DATA-TRANSFER RESULTS MEAN

Hayes's Optima 144 + FAX144 and Optima 96 + FAX96, Computer Peripherals' ViVa 14.4/FAX Modem, Practical Peripherals' Practical Modem 14400FXSA, and Zoom Telephonics' VFX V.32bis products had the best performance in these tests. In the Data Upload and Data Download tests with the incompressible file, the Optima 96 + FAX96 and the Zoom VFX V.32 performed more slowly than competing products, possibly because their error-control implementations add extra overhead when files are being transferred under impaired line conditions such as our long local loop. The U.S Robotics modems were unable to complete the data-transfer tests without adding initialization strings and adjusting the modems' flow control.

AFTER YEARS OF LOSING MARKET SHARE TO DELL, IT SEEMS IBM AND COMPAQ WANT TO PLAY HARDBALL.

CUSTOMER SATISFACTION SURVEY

Source: Reliability Ratings™ - 1992 PC Vendor Survey*

SERVICE		TECHNICAL SUPPORT		PRICE		RELIABILITY	
1. DELL	(8.63)	**1. DELL**	(8.09)	**1. DELL**	(8.82)	**1. DELL**	(8.96
2. APPLE	(8.06)	2. IBM	(7.99)	2. COMPAQ	(6.62)	2. COMPAQ	(8.95
3. IBM	(8.01)	3. APPLE	(7.72)	3. APPLE	(6.58)	3. APPLE	(8.58
4. COMPAQ	(8.00)	4. COMPAQ	(7.71)	4. IBM	(6.01)	4. IBM	(8.54

*Based on customer ratings from a sample of the 500 largest corporate PC sites in America.

What can we say?

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486P DESKTOP	i486™ SX, 25 MHz	4 MB	120 MB	SUPER VGA COLOR	$1,799
486P DESKTOP	i486 DX, 33 MHz	4 MB	170 MB	ULTRASCAN™ 14C	$2,299
486D DESKTOP	i486 DX2, 50 MHz	4 MB	170 MB	ULTRASCAN 14C	$2,749
486D DESKTOP	i486 DX2, 66 MHz	8 MB	230 MB	ULTRASCAN 15FS	$3,349
325NC COLOR NOTEBOOK	i386 SL, 25 MHz	4 MB	60 MB	VGA COLOR LCD	$2,799

All systems include MS-DOS® 5.0, and one floppy drive. Dell systems are custom configured. Systems listed above represent a sampling of configurations available.

intel inside

Survey was conducted by Reliability Ratings, Needham, MA. The data is quoted from a publicly available 40 page report. Reliability Ratings, the research company, is not affiliated with Dell Computer Corp. and does not endorse its products.

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SO FAR, WE'RE AHEAD EIGHT TO NOTHING.

ØGRADEABILITY		FUNCTIONALITY		MONITOR		OVERALL SATISFACTION	
DELL	(8.52)	**1. DELL**	(8.73)	**1. DELL**	(8.31)	**1. DELL**	(8.77)
APPLE	(7.64)	2. COMPAQ	(8.45)	2. APPLE	(8.08)	2. COMPAQ	(8.45)
COMPAQ	(7.48)	3. APPLE	(8.40)	3. COMPAQ	(7.60)	3. APPLE	(8.14)
IBM	(6.91)	4. IBM	(7.96)	4. IBM	(7.38)	4. IBM	(7.89)

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its bundled software, and it is backed up by seven-day-a-week technical support and a lifetime warranty.

The PM 14400FXSA package includes a phone cable and QuickLink II. A serial cable is not included. At $549, the product is a good value.

The modem uses an AT&T chip set. Its most distinctive external feature is its helpful 12-character, front-panel LCD. This display supplements the device's 10 LED displays, offering detailed information about speed, data compression, and line quality. The LCD tracks the connection through indicators for dialing, connecting, and syncing. The display also indicates when the fax modem is sending or receiving pages.

The device's case is bulky and may may take up too much room on your desk. The RJ-11 connections for phone and data lines are clearly etched into the back panel but are slightly misaligned.

Smith Microsystems' QuickLink II is a decent communications and fax package, with a phone book function and a slightly kludgy interface. It is not a great solution for long-term use but not a bad choice for getting started.

The fairly brief but concise documentation contains the basic Hayes AT command-set descriptions, along with troubleshooting information. Practical Peripherals is a subsidiary of Hayes Microcomputer Products. Among the companies whose products we reviewed, Practical Peripherals provides the most extensive phone support hours: weekdays from 6:00 to 8:00, weekends from 8:00 to 4:00. A CompuServe forum and a 24-hour BBS are also available.

The PM 14400FXSA is a solid buy, especially for the beginner. It works well with its bundled software and other Class 1 applications. It's a good choice for its reasonable price and fast performance, especially if you don't mind giving up a little desktop space.

Practical Modem 14400FXSA
Practical Peripherals Inc. (Subsidiary of Hayes Microcomputer Products Inc.), 375 Conejo Ridge Ave., Thousand Oaks, CA 91361; 800-442-4774, 805-497-4774; fax, 805-374-7200. List Price: $549.
Circle 464 on reader service card

KeepInTouch Card

by Angela Gunn

High-speed portable fax modems are about to get a new, slimmer look thanks to AT&T Paradyne's KeepInTouch Card. The long-time modem manufacturer became one of the first vendors to release a high-speed PCMCIA (Personal Computer Memory Card International Association) fax data modem that can be installed inside any portable PC that provides a PCMCIA standard slot.

Though the product was available only in a beta version at the time of our evaluation, PC Magazine Labs did run informal tests on the KeepInTouch Card modem, which should be available by the time you read this. As beta hardware, the product wasn't quite ready for prime time when it hit our labs, but the features we saw and the promise it holds deserve mention.

The PCMCIA port standard specifies a credit-card-size slot for laptops and portables. The AT&T modem, which complies with the PCMCIA standard as well as the earlier JEIDA (Japan Electronic Industry Development Association) standard, sends both faxes and data at 14.4 kilobits per second. It uses a new variation of the Paradyne chip set; an earlier version of this chip set helped earn the AT&T Comsphere 3810 our Editors' Choice designation (for more information, see "Maximum Modems: 14,400 bps and Rising," March 17, 1992). The KeepInTouch Card will ship with a communications software program; AT&T is also working with major software manufacturers to include the KeepInTouch Card as a configuration option in their packages.

The charm of the PCMCIA slot is its versatility: Any peripheral that can be built as a PCMCIA card can be slid in and out of a PCMCIA slot as easily as swapping floppy disks. So far, modems and flash RAM cards have proven popular with users. 14.4-Kbps PCMCIA fax modems using the Rockwell chip set should begin to appear by the end of this year.

We saw not only a traditional "wire-line" modem but also a prototype of a wireless PCMCIA modem. That version works in conjunction with a portable AT&T cellular phone. AT&T is also working with RAM Mobile Data, a major player in the wireless market, to build PCMCIA hardware for RAM's worldwide packet-radio cellular modem network.

Granted, a few pieces were missing when we saw the modem. AT&T has not structured the modem to download new configuration upgrades from its BBS, as the Comsphere can. The phone-jack connector—a bulky plastic unit, one of PCMCIA's main drawbacks—will be replaced one day by a silver-dollar-size snap-on connector, but it's not ready yet. Most significantly, transmission quality didn't quite measure up to that of the external modems we tested. Only four pages of our five-page fax and five-page letter were transmitted. Otherwise, throughput was acceptably fast.

This is a new technology; inadequacies in execution will be improved upon. But the ability to slide a modem into a business-card case is sure to be attractive to users on the move. □

Supra Corp.

SupraFAX Modem V.32bis

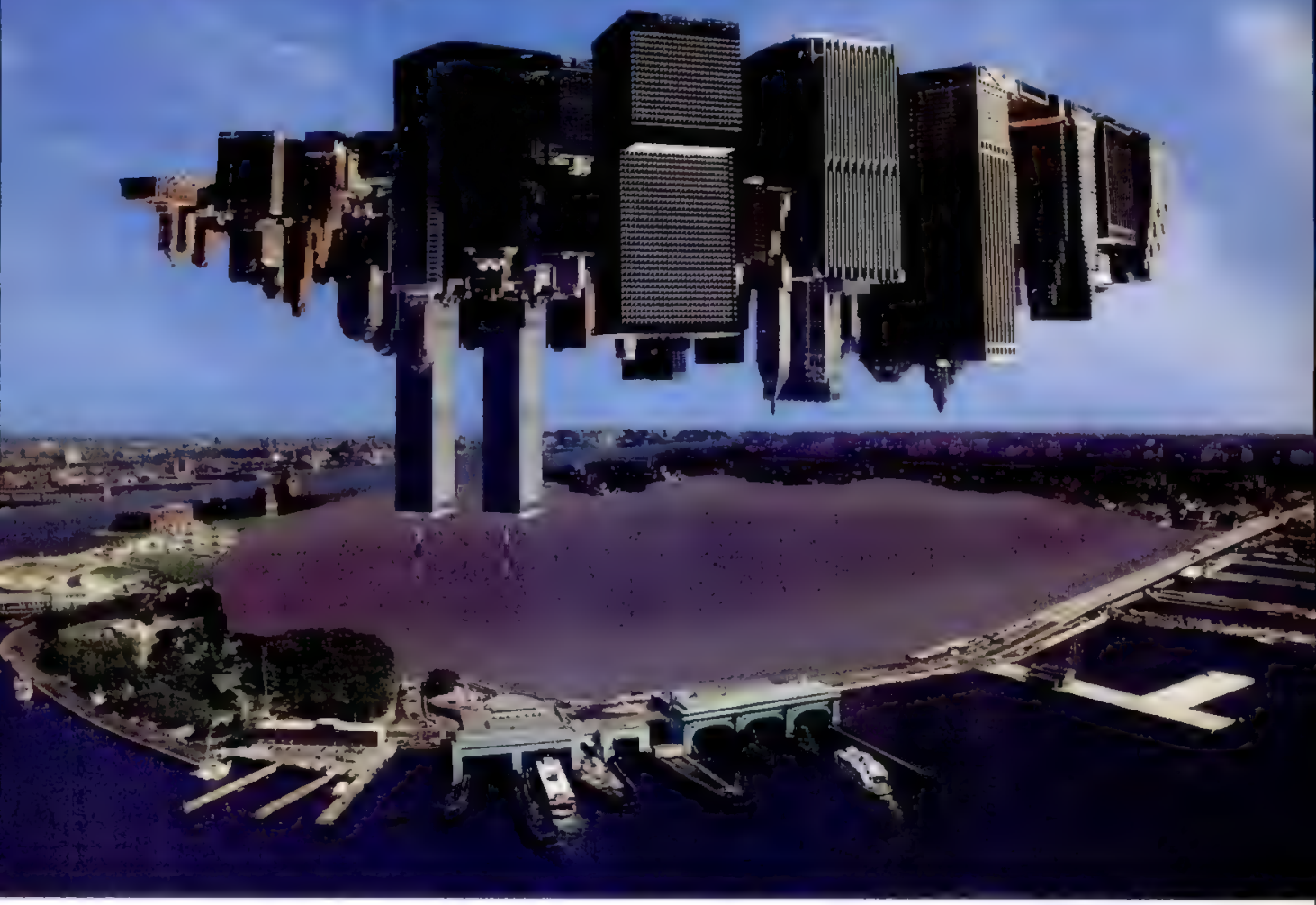
BY TONY POMPILI

Supra Corp.'s SupraFAX Modem V.32bis packs quite a wallop for such a small package. The product's only flaw is a power switch that is too easy to turn off accidentally. The combination of a streamlined display and versatile LED readout makes troubleshooting easy with this high-speed fax modem.

Priced at $439.95, the SupraFAX Modem V.32bis is one of the least expensive external V.32bis fax modems available, and one of the few modems we tested that comes with a serial cable. The device comes bundled with your choice of two Class 2-compatible fax programs: Delrina Technology's WinFax Lite, for Windows, or Thought Communications' FaxTalk Plus, for DOS.

The SupraFAX uses the Rockwell

A New Corporate Downturn Caused By Interrupted Modem Transmissions.



Your daily business routine could be turned upside down by an interrupted modem transmission. One moment you're sending or receiving data, the next moment you're fuming. Has the Escape Sequence used by your modem just interrupted your transmission?

While our real world examples of interrupted transmissions due to escape sequences have been limited to our BBS and Hayes' own data files, our analysis is based on the theoretical possibility that you can experience this situation in your business. Will you be the one who proves our theory?

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The paper discusses escape sequences and these possibilities. For a *FREE* copy, call 800-374-8388, FAX your request to 404-729-6650, or download the paper from the Hayes BBS. Call or fax us today for your copy of the White Paper. Because your world is hectic enough without being ambushed by a modem with an attitude.

Hayes

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CIRCLE 136 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

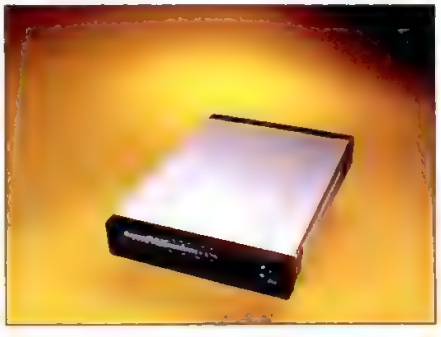
Fax Modems

In alphabetical order by company
■ = YES □ = NO

	Computer Peripherals Inc. **ViVa 14.4/ FAX Modem**	Hayes Microcomputer Products Inc. **Optima 96+ FAX96**	Hayes Microcomputer Products Inc. **Optima 144+ FAX144**	Intel Corp. **SatisFAXtion Modem 400/e**	Practical Peripherals Inc. **Practical Modem 14400FXSA**	Supra Corp. **SupraFAX Modem V.32bis**
List price	$449.00	$419.00	$519.00	$549.00	$549.00	$439.95
Standard Configuration						
Dimensions (HWD, in inches)	5.4 x 2.1 x 5.7	1.5 x 5.5 x 9.5	1.5 x 5.5 x 9.5	1.3 x 5.5 x 9.6	3 x 5 x 10	4.6 x 6.5 x 1
Chip set	Rockwell 144DP	Proprietary	Proprietary	Rockwell RC144AC	AT&T 14.4 MA	Rockwell RC144AC
RS-232 included	□	□	□	□	□	■
Phone cable included	■	■	■	■	■	■
Software included	QuickLink II, WinFax Lite	Smartcom EZ, Smartcom FAX	Smartcom EZ, Smartcom FAX	SatisFAXtion	QuickLink II	FaxTalk Plus, WinFax Lite
CAS supported	□	■	■	■*	□	□
Fax BIOS supported	□	□	□	□	□	□
Configurable through software	■	■	■	■	■	■
Configurable through DIP switches	□	□	□	□	□	□
Status Lights						
Transmit data	■	■	■	■	■	■
Carrier detect	■	■	■	■	■	■
Auto-answer	■	■	■	■	■	■
Modem ready	■	■	■	■	■	■
2,400 bps	■	■	□	■	■	■
Request to send	□	□	□	□	■	■
Test	□	□	□	□	■	■
Receive data	■	■	■	■	■	■
Off-hook	■	■	■	■	■	■
Error control	□	■	■	■	■	■
Terminal ready	■	■	■	■	■	■
High-speed indicator	■	■	■	■	■	■
Clear to send	■	□	□	□	■	■
Data/Fax Modulation and Error Control						
V.32/V.32bis	■■	□■	■■	■■	■■	■■
V.29/V.22bis	■■	■□	■□	■□	■□	■■
V.42/V.42bis	■■	□□	■■	■□	■■	■■
Group 2/Group 3/V.17 fax	□■■	■■□	■■□	■■□	□■□	□■■
MNP levels supported	1–5	2–5	2–5	2–5	1–5	2–5, 10

* Via device driver

chip set. Probably the modem's most distinguishing characteristic is its size: only 4.6 by 6.5 by 1.0 inches (HWD). Although there's little room on the front panel, Supra Corp. overcomes this limitation elegantly with an alphanumeric LCD panel that shows two-character abbreviations indicating speed, data compression, error control, connect status, and use of modem or fax mode. Four standard LEDs augment the LCD.



The product's connectors are all well marked. But the front-panel power button, although conveniently accessible, is not recessed and can be too easily turned off by accident during a transmission.

WinFax Lite and FaxTalk Plus each provide a rich assortment of features, including automatic document conversion and the ability to fax directly from within DOS and Windows applications. Both programs were able to send a mix-

	U.S. Robotics Inc. **Courier HST Dual Standard Fax**	U.S. Robotics Inc. **Courier V.32bis Fax**	U.S. Robotics Inc. **Sportster 9600 Fax**	U.S. Robotics Inc. **Sportster 14400 Fax**	Zoom Telephonics Inc. **Zoom VFX V.32**	Zoom Telephonics Inc. **Zoom VFX V.32bis**
	$1,295.00	$995.00	$439.00	$549.00	$399.00	$449.00
	6.3 x 10.3 x 1.5	6.3 x 10.3 x 1.5	6.6 x 5 x 1.8	6.6 x 5 x 1.8	6.1 x 8.5 x 1.6	6.13 x 8.5 x 1.6
	Proprietary	Proprietary	Proprietary	Proprietary	Rockwell RC96AC	Rockwell RC144AC
	☐	☐	☐	☐	☐	☐
	■	■	■	■	■	■
	BlastFax PC 1.01	BlastFax PC 1.01	BlastFax PC 1.01	BlastFax PC 1.01	MTEZ with ExpressFax 1.17	MTEZ with ExpressFax 1.17
	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐
	■	■	■	■	■	■
	■	■	■	■	■	☐
	■	■	■	■	■	■
	■	■	■	■	■	■
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	■	■	■	■	■	■
	■	■	■	■	■	■
	■■	■■	☐■	■■	☐■	■■
	■■	■■	■■	■■	■■	■■
	■■	■■	■■	■■	■■	■■
	☐■☐	☐■☐	☐■☐	☐■☐	☐■☐	☐■■
	2–5	2–5	2–5	2–5	1–5	1–5

ENDS

ture of ASCII and .PCX documents, and receive, view, and print multipage documents sent from a typical Group III fax machine.

Documentation includes a quick-start guide and a reference manual. Technical support by phone is limited to weekdays from 9:00 to 4:00 Pacific time over a toll number. We found the line to be ceaselessly busy. BBS and fax support are also available, however. The SupraFAX Modem V.32bis comes with a five-year warranty and money-back guarantee. Its size, easy setup, rich display, and excellent pricing make it a great choice for anyone looking for high-speed modem and fax capabilities.

SupraFAX Modem V.32bis
Supra Corp., 7101 Supra Dr. SW, Albany, OR 97321; 800-727-8772, 503-967-2400; fax, 503-967-2401. List Price: $439.95.
Circle 465 on reader service card

U.S. Robotics Inc.

Courier HST Dual Standard Fax
Courier V.32bis Fax
Sportster 9600 Fax, 14400 Fax

BY TONY POMPILI

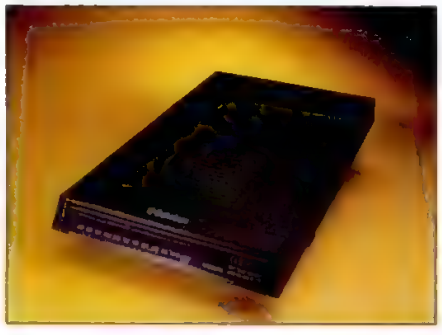
U.S. Robotics' Courier HST Dual Standard Fax and Courier V.32bis Fax modems deliver all the high-end data-transfer power you'd expect for $1,295 and $995 respectively. The Sportster modems are more affordable. But despite their many features, all four modems would benefit from easier setup and a more robust bundled fax application.

The HST Dual Standard Fax stands out from the V.32bis by its support for 16.8-Kbps connections with other HST (high-speed technology) modems. The Dual Standard supports the international V.32bis modulation standard and USR's own HST protocol. The HST Dual Standard Fax and the V.32bis Fax have diagnostics and can track connection time.

Based on USR's own chip set, the $549 Sportster 14400 and $439 Sportster 9600 both support V.32; the Sportster 14400 supports V.32bis as well. The 14400 can achieve connect rates of 14.4 Kbps, the less expensive model up to 9.6 Kbps.

The front-panel display on the Courier modems is enhanced with LEDs indicating fax and synchronous-mode transmissions. The Courier products provide a front-panel, voice/data switch that's useful if you have only one phone line.

USR ships Blast Fax PC 1.01 with all its fax modems. Blast Fax will work only with USR modems. Although the program offers a well-designed Windows-like DOS graphical interface, it has basic functional problems, the most serious being its inability to convert .PCX files to



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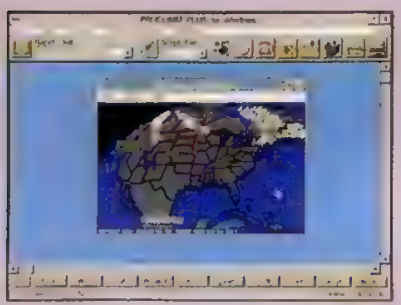

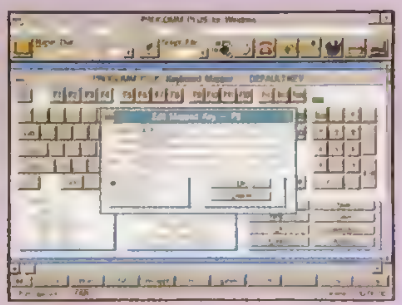

DATASTORM

DATASTORM TECHNOLOGIES, INC

P.O. Box 1471 • Columbia, MO 65205 • 314.443.3282

CIRCLE 083 ON READER SERVICE CARD

fax format. The company now has a version that performs the conversion, but it was available too late for us to test.

We found all four modems hard to configure for third-party communications and fax applications. You must select "U.S. Robotics" from the software setup menu, rather than using the default modem string, and turn on flow control.

U.S. Robotics provides a two-year warranty with its Courier modems and five years with the Sportsters. Toll-free support is available weekdays from 8:30 to 7:00 eastern time; 24-hour BBS support is also available.

The Courier modems are best suited for demanding, high-speed data communications environments where only occasional faxing is needed. If faxing is your primary concern, cheaper modems will do as well. The less expensive Sportster devices will serve you well if your fax documents are mostly text rather than .PCX graphics files and you don't mind using Blast Fax PC.

Courier HST Dual Standard Fax
Courier V.32bis Fax
Sportster 9600 Fax
Sportster 14400 Fax
U.S. Robotics Inc., 8100 N. McCormick Blvd., Skokie, IL 60076-2920; 800-342-5877; fax, 708-982-5235. List Price: Courier HST Dual Standard Fax, $1,295; Courier V.32bis Fax, $995; Sportster 9600 Fax, $439; Sportster 14400 Fax, $549.
Circle 466 on reader service card

Zoom Telephonics Inc.

Zoom VFX V.32
Zoom VFX V.32bis

BY TONY POMPILI

Zoom Telephonics' VFX V.32 and V.32bis fax modems exemplify the company's flair for high functionality at a reasonable price. The modems provide not only V.32 and Group III fax compatibility but also support both Class 1 and Class 2 fax modem board control standards.

The devices come with a phone cable and WordPerfect Corp.'s MTEZ Standard with ExpressFax. The modems are based on the Rockwell chip set. The only difference between the two is that the VFX V.32bis supports 14.4-Kbps data connection rates and the V.17 14.4-Kbps fax standard; the V.32 device handles 9.9-Kbps connection rates.

The products come with standard LED indicators plus high-speed and error-control status lights. In testing, the modems instantly connected with a 9.6-Kbps on-line service using V.32.

The VFX V.32's and V.32bis's support

for both Class 1 and Class 2 fax modem control standards gives them wide compatibility with existing and future fax applications written to these standards. MTEZ comes with a Class 1 driver for DOS applications. A $20 option is WinFax Lite, Version 2.0, a streamlined version of Delrina Technology's popular full-featured WinFax Pro, which supports Class 2. Both modem packages let you create groups of recipients and phone books, schedule transmissions, and redirect printer output from applications to a fax machine or fax modem.

If the VFX V.32 and VFX V.32bis have a fault, it is Zoom Telephonics' product support. The company provides a decent seven-year warranty on the modems, but its technical support hours are from 9:00 to 5:00 eastern time on weekdays only—most of the products we reviewed have more total weekly hours.

The VFX V.32 and VFX V.32bis fax modems provide a rich assortment of modem functionality and software flexibility to satisfy Windows and DOS fax users. They reflect Zoom's reputation for building a solid product at a decent price. □

Zoom VFX V.32
Zoom VFX V.32bis
Zoom Telephonics Inc., 207 South St., Boston, MA 02111; 800-631-3116, 617-423-1072; fax, 617-423-9231. List Price: VFX V.32, $399; VFX V.32bis, $449.
Circle 467 on reader service card

CIRCLE 213 ON READER SERVICE CARD

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"For professionals, Illustrator 4.0 for Windows is an exceptional do-it-all application..." InfoWorld, 1992.

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Publish ★★★★★

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ADOBE

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CIRCLE 368 ON READER SERVICE CARD

24-BIT PAINT PROGRAMS

In *Living* Color

by Luisa Simone

Painting with 16.8 million colors has never been more affordable. But differing philosophies about art leave these three programs with little in common except low prices.

Thanks to Truevision's Targa boards, the PC has a long and illustrious history as the platform of choice for professional-level paint programs. Before color Macintoshes existed, people were creating sophisticated paintings with custom-configured PC ATs. So it came as a big surprise that our selection process for 24-bit painting programs yielded only three programs out of the multitude of raster products on the market: CA-Cricket Paint ($595), Fractal Design Painter for Windows ($399), and Mathematica's Tempra Pro ($695).

Our selection criteria were stringent: Programs qualified only if they handled 24-bit images, had the ability to operate on a wide variety of standard graphics adapters, cost less than $1,000, and—most important—emphasized painting functions.

The best way to differentiate these three programs from other raster-based graphics packages is to describe what they are not. They are not workstation paint programs like Quantel's Paintbox. They are not entry-level graphics products like ZSoft Corp.'s PC Paintbrush 5+. And they are not image editors like Aldus PhotoStyler and Picture Publisher.

IN THIS REVIEW

CA-Cricket Paint 366
Fractal Design Painter for Windows 368
Tempra Pro 376

THE HIGHEST END

Artists have been using top-flight products such as AT&T RIO Animator, Time Arts Lumena, Truevision Image Paint Software (TIPS), and Wasatch Portfolio for close to 10 years. If you want immediate access to video images, the ability to work at extremely high resolutions, or the ability to work with both raster and vector information, you must buy an expensive product as well as specialized hardware.

For example, Wasatch Portfolio can handle resolutions of up to 4,000 lines per inch (for photographic quality when output to a film recorder) and provides integrated modules for both raster and vector func-

Illustrations by Steven Lyons

tions. But it requires the ATVista video card and 64MB of RAM, and it costs $6,995. All of the other products present more modest but similar scenarios: Each version of the program is optimized to run with a specific video card, and prices range from $795 to $2,495.

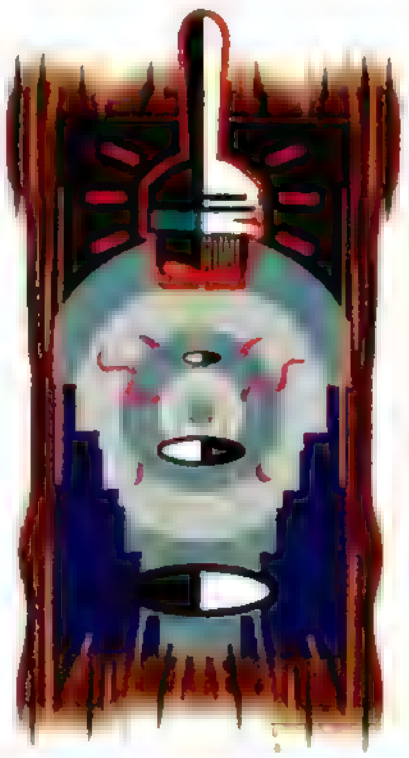
So while these programs still define the high end, we must turn to products such as CA-Cricket Paint, Fractal Design Painter, and Tempra Pro to define the mass market. All three programs are flexible enough to run on a wide variety of display devices and at a number of different resolutions. We tested the products using a Compaq Deskpro 386/25M configured with 16MB of RAM, an Artist Graphics WinSprint 200/24 Windows Graphics Accelerator card, and a Wacom 510C-SD pressure-sensitive tablet.

Flexibility in display support is crucial to the business user who may own only a Super-VGA system. All three of the programs reviewed here allow you to open, view, and edit 24-bit images on lower resolution displays. Advanced dithering techniques interpret the 24-bit information stored on-disk and give you as accurate a screen display as possible.

Of course, these advantages come with caveats. For example, you must check that Tempra Pro, which is DOS-based, has a driver for your graphics card. Even Painter and Cricket Paint, which *should* work harmoniously with any Windows-compatible card, exhibited idiosyncrasies. Cricket Paint had minor problems with area fills and masks. And in 24-bit mode, Painter, Windows, and NetWare were less than cooperative—although we couldn't determine whether the fault lay with the application, the graphical environment, the networking software, or the video driver.

While these products are not meant to rival dedicated workstation paint programs, they are able to produce high-quality images. Even at standard resolutions of 72 to 300 dots per inch, these programs can generate images for the most demanding print projects, the most sophisticated multimedia presentations, and the most exacting film recorders.

In fact, the quality of the images produced by mass-market raster programs has been so good that the big boys have begun to feel the pressure. Though they are still too hardware-dependent or too expensive to qualify for this story, the introduction of programs such as Wasatch Portfolio VGA ($2,995) and RIO VGA ($895) are proof that the high-end would like to go mainstream.



For the most demanding print projects, 24-bit paint programs can generate high-quality images.

TOO MUCH POWER?

It may seem ridiculous to suggest that these products also compete with entry-level paint programs. In fact, conventional wisdom states that the 256 colors offered by 8-bit programs are sufficient for color ink jet and laser printouts or on-screen presentations. For instance, 256 shades of gray are adequate for monochrome work, such as most desktop publishing, and are the maximum number of shades in any monochrome image, whether it is produced by a 24-bit program or an 8-bit program.

All of this has not been lost on the folks at Fractal Design Corp. The company is addressing the needs of the low-end, mostly monochrome market with the forthcoming Fractal Design Sketcher for Windows. Though limited to gray-scale images, Sketcher offers many of the same painting techniques as its high-end sibling at a fraction of the cost—$149 list.

Eight-bit color also has advantages. You just can't animate screens quickly enough using 24-bit images. In fact, animation and multimedia screen-show programs such as Autodesk Animator Pro, Gold Disk's Animation Works Interactive, and Macromedia's Action! can handle only 256-color images. Finally, 8-bit programs require a minimal hardware investment—less memory, smaller hard disks, slower processors, and lower resolution displays. And list prices under $200 make these programs affordable for everyone.

Two of the best in the 8-bit field are veterans: PC Paintbrush 5+ ($149) and Electronic Arts' Deluxe Paint II Enhanced ($135). Both of these DOS-based packages will run on virtually any system, at a variety of screen resolutions, and both have all the paint tools you need to create attractive images. Some of Paintbrush's paint tools can be configured to mimic traditional painting techniques, and the package supports flatbed and hand scanners and video-capture boards. It also offers many of the same retouching and special-effects filters you ordinarily find in a dedicated image-editing package. And while it does a fine job of working with color images, it really shines in its handling of gray-scale images. The Softbrush settings for the Paintbrush, Airbrush, and Smear Paintbrush tools make it easy to correct and enhance gray-scale images.

Deluxe Paint lacks scanner support but has more sophisticated paint tools than Paintbrush. The unique Perspective tool allows you to paint in three dimensions to add depth to your image, and Brush Wrap lets you wrap an image around a three-dimensional object. Also unique at the low end are anti-aliasing, colorizing, and pattern fills that can be optimized for screen display or printed output. Deluxe Paint also lets you create

Our Contributors: LUISA SIMONE, the author of *Microsoft Publisher* (Microsoft Press, 1992), is a contributing editor to *PC Magazine*. JUDY ARMSTRONG is a multimedia artist. CHELSEA SAMMEL is a free-lance illustrator. ROSSANAH WAGGONER is a free-lance artist for Jet Age Graphics.

animated effects by using its gradient palettes and color cycling. And when you're finished painting, you can gather your images into a presentation and view them using Gallery, a screen-show utility.

But anyone who has ever tried to create sophisticated images with an 8-bit paint program has probably been frustrated by the indexed palettes these programs use in order to manage the 256 colors contained in each file. Unless you can plan all the colors used by your picture in advance, you will find that transparency effects, anti-aliasing, and blends produce erratic results. Each effect contains innumerable transition colors. An 8-bit program must do its best to map those transition colors to the limited number of hues that already exist in the palette: Color conflicts are inevitable.

True 24-bit paint programs do not depend on an indexed palette. With 16.8 million possible colors, these programs can generate the transition colors necessary for producing believable transparent overlays, delicate anti-aliasing or airbrushing, and smooth blends. And you can take your 24-bit, true-color image and export it as an 8-bit color-mapped file—leaving the hard work of producing an optimized palette to the software.

While testing color reduction, we discovered that not all 24-bit paint programs are created equal. For example, Fractal Design Painter stores only RGB information, so you can't export a color-mapped file (one that uses a fixed, as opposed to an indexed, palette). And if you run Tempra Pro on an 8-bit system, the program will revert to using an indexed palette.

EDITORS' CHOICE

• Apples and Oranges

The three packages in this review, CA-Cricket Paint, Fractal Design Painter for Windows, and Tempra Pro, approach image creation in such disparate ways that your purchase decision should ultimately reflect your philosophy of art more than your philosophy of interface design.

For those who want a PC to enhance rather than redefine their creative processes, Fractal Design Painter for Windows ($399) represents a technological breakthrough. Its interface lets you create works of art as fluidly as you would with a brush and canvas, while its sophisticated algorithmic techniques allow the program to replicate faithfully the interaction of paper textures and a variety of implements such as watercolors, crayons, pen and ink, and felt-tip markers. For expanding your creative horizons without leaving the comfort of traditional methods, Painter is unsurpassed.

With the exception of its remarkable cloning facility, however, Painter's strength is also its weakness: if you can't do it in real life, you can't do it in Painter. CA-Cricket Paint ($595) goes to the opposite extreme: You can use all of its myriad tools in almost any combination. Furthermore, it has some tricks up its sleeve that could never be accomplished without the aid of a computer, such as its exceptional pattern creation and handling, and 8-bit masking. For $100 more, you can get CA-Cricket Studio, which includes CA-Cricket Image, for the ability to scan and adjust images globally. Similarly to Painter, though, Cricket Paint's ultraflexibility proves its greatest weakness. Because of the simultaneous interaction of all those tools, it is difficult to keep track of which ones are active at any time.

Tempra Pro ($695) is the only of these three packages that runs under DOS, and it is the only one that supports image acquisition from scanners and frame-grabber boards. It comes bundled with Tempra Show, Mathematica's multimedia authoring software. Unfortunately, it falls far short of the other two packages in creative painting; even as an image-preparation tool for multimedia presentations, it comes up lacking. The interface is dated and the fact that the program reverts to a palette-based approach to color-handling results in some unwelcome surprises when you are working in 24-bit mode.

THE CREATIVE EDGE

Drawing a line that separates the three programs reviewed here from image-editing programs such as Aldus PhotoStyler or Micrografx's Picture Publisher is no easy task. Common sense tells us that there are a limited number of ways to manipulate the pixels in a bitmapped image, and so similarities between paint and image-editing software are inevitable. So though they differ in degree and kind, all of the programs reviewed here offer masking capabilities, basic filters, and the ability to edit scanned photographic images—just like image-editing programs.

On the other hand, paint programs offer none of the production-oriented features that we expect from image-editing software, such as four-color separations, resampling functions, or gamma correction. (For reviews of image-editing programs, see "True-Color Image Editing: Darkroom, R.I.P.?" in the September 29, 1992 issue of *PC Magazine*.)

As image-editing programs become more flexible and paint programs become more powerful, the differences between these two genres may ultimately be more a matter of mind-set than feature set: These three paint programs provide tools that are optimized for image creation rather than image manipulation. For example, Tempra Pro offers special geometry functions that allow you to paint complex shapes and repeating patterns easily. Cricket Paint lets you create unique textures using another image as your source. And Painter can mimic the behavior of conventional art media.

These programs demonstrate two trends worth noting. Both Painter and Cricket Paint support pressure-sensitive input devices such as the Wacom digitizing tablet (pressure sensitivity allows you

to change the intensity and width of a brush stroke by pressing down more strongly on the tablet). Suddenly a software program can reproduce the nuances of an artist's touch. This function is so important to Painter that the company actually enhances the Wacom Windows driver—with spectacular results. Those users who don't own a pressure-sensitive input device will be grateful for Painter's ability to interpret the velocity of a mouse's movement instead.

On a more basic level, all three programs place a strong accent on customizable brushes. (For a more detailed discussion of configuration options, see the sidebar "Profile of a Brush.") Using options such as transparency, tint, cloning, quad gradients, ink penetration, and textured brush strokes allows you to create unique painting tools.

While evaluating the three programs reviewed here, keep in mind that they all provide a different mix of painting and editing tools. On one end of the spectrum, Tempra Pro attempts to straddle the dividing line between painting programs and image-editing software by stressing its built-in filters and providing drivers for scanners and video-capture boards. On the other end, Fractal Design Painter emulates traditional media so closely that oil colors overlaid improperly will muddy up and watercolors remain wet until you "dry" them. Somewhere in the middle is Cricket Paint, offering an eclectic assortment of functions and the freedom to concoct any tool you can imagine. Only you can determine whether you need an all-in-one solution or a more specialized approach to image creation. In the final analysis, the painting program that is most successful is the program that gives you the creative edge.

In creating this airplane image, Rossanah Waggoner made extensive use of CA-Cricket Paint's transparent, airbrush, and blending functions.

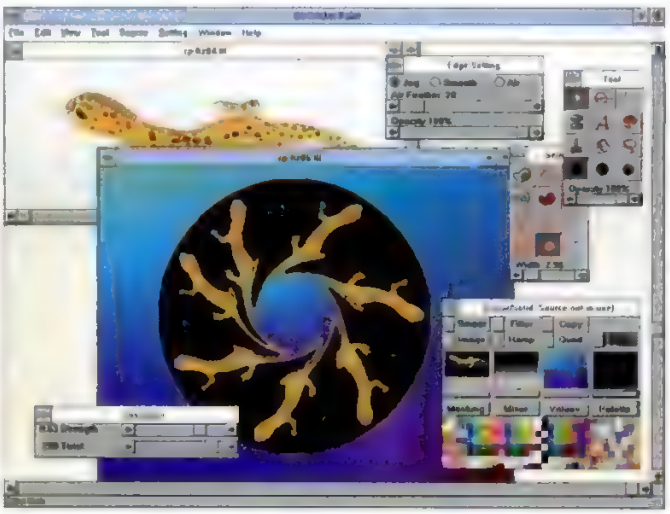
Computer Associates International Inc.

CA-Cricket Paint, Version 1.0

CA-Cricket Paint blurs the line that has traditionally separated paint and image-editing programs. This $595, Windows-based program contains customizable brushes, powerful masking techniques, and sophisticated image-editing filters. But best of all, the program integrates these functions so well that it is impossible to tell where the painting tools end and the editing tools begin.

When you first open Cricket Paint, you are presented with three floating palettes: Tool, Shape, and Source. The obvious combination of the brush tool, a round tip, and a solid color gives you commonplace painting functions. But with 7 tools, 12 shapes, and 8 sources, adventurous artists will quickly move past conventional tools to totally ingenious painting techniques. For example, if you combine the arrow tool and the lasso "shape," you can easily select irregular patches of your picture for modification.

The Sources palette, however, is the cornerstone upon which Cricket Paint's power is built, Choosing the Filter or Copy Sources allows you to access image-editing functions—such as sharpening, blurring, and cloning—but with the fluidity of a brush. The Image option in the Source palette deserves special mention, because it transcends the standard idea of patterns. Either the current selection or an entire picture can be dumped into the Image box. You can then use the image as a stamp, reflect it horizontally and vertically for a tile effect, or capture the luminance value as a texture. We used these features extensively during testing: A photograph of the desert became a background pattern, and converting the picture of the lizard we created to a texture allowed us to combine it with the background and change its color simultaneously.



To create this image with CA-Cricket Paint, we scaled and rotated the original image of the lizard, then used Barrel Distort to create the whirlpool effect.

Cricket Paint's robust painting features are augmented by strong editing functions and specialized tools. For example, the scale and rotate command is an elegant way to modify images. We were impressed with the program's heavy-duty functions that can protect either a selected area or specified colors. With eight bits devoted to the mask plane, Cricket Paint can use white for 100 percent protection, black for complete exposure, and 254 shades of gray to vary the mask's opacity.

Cricket Paint is not intended to compete against true image-editing programs, however. In fact, Computer Associates would like you to purchase both CA-Cricket Paint and the complementary CA-Cricket Image (the bundle, called CA-Cricket Studio, is $695). Cricket Paint's masking features rival image-editing programs such as Aldus PhotoStyler, however. Cricket Paint also offers a number of special effects that are reminiscent of image-editing programs. For example, the Barrel Distort command can punch 3-D spheres into a picture and generate whirlpools of color.

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FACT FILE

CA-Cricket Paint, Version 1.0

Computer Associates International Inc., 1 Computer Associates Plaza, Islandia, New York 11788-7000; 800-225-5224, 516-225-5224; fax, 516-342-5329

List price: $595

Requires: 386-based PC or better, 2MB RAM, Super VGA graphics adapter or better, Microsoft Windows 3.x, mouse or digitizing tablet. 4MB RAM and 8-bit graphics adapter or better recommended

In short: CA-Cricket Paint is just too good to pass up. Despite some annoying performance problems, the combination of totally configurable painting tools and powerful editing functions make this $595 program a winner

472 ON READER SERVICE CARD

Though it can hardly be considered a specialized tool, Cricket Paint is the only program in our roundup that supports scalable type such as Adobe Type Manager or TrueType fonts. During testing, we found that Cricket Paint insists on treating type as either a stamp or a brush. But this did not prove a limitation, and made short work of creating a drop shadow behind the logo.

AN EMBARRASSMENT OF RICHES

There are, however, drawbacks to all of this flexibility. For one thing, the customization options never end. Each of the eight Sources has several associated variants. For example, the Copy option gives you four different ways to clone an image, including scaling and rotation, mirroring, and perspective.

In addition, Cricket Paint allows you to control the opacity of the paint, the degree to which anti-aliasing is applied, color thresholds for the fill and lasso tools, the width of a brush, and the texture. Keeping track of these settings and managing their disparate dialog boxes can be daunting. None of this would be a problem if you could save a complex configuration as a custom brush, but you cannot. Typically, you'll find yourself wondering why the Unpaint function isn't erasing completely, only to discover that the texture and transparency settings are still in effect.

The program needs improved memory-management techniques, especially for the Undo function. Even when we increased the size of the Undo buffer from the default 390K to 780K (the maximum is 1.2MB), Cricket Paint was unable to undo operations involving large portions of the canvas. Even more annoying, the program tended to leave artifacts in the picture when undoing an area fill.

Many of the performance problems we encountered were related to incompatibilities with our Artist Graphics WinSprint 200/24. (You may not experience these errors with other 24-bit boards.) So although the masking function always worked, we were sometimes unable to view the mask. On other occasions (specifically when using the masked selection as a stamp), Cricket Paint painted with the bright green mask color rather than the image's true colors.

Artists looking for a paint program that is sensitive to their touch will be disappointed with Cricket Paint's response to Wacom tablets. The only tool that responds to pressure is the paintbrush, but in our testing it could not produce subtle gradations between light and heavy strokes. Worse, quick strokes resulted in a series of unconnected dots, rather than a single fluid brush mark. Overwhelmed by the computational tasks associated with complex brushes, Cricket actually loses information if you paint too quickly.

Although these problems need to be addressed, the program's advanced and versatile painting tools make it possible—indeed easy—to find workarounds to all of these difficulties. Perhaps more important, wonderfully quirky features tip the scales in Cricket Paint's favor. Cricket Paint can import vector-based .WMF files, converting them to bitmaps upon import. In addition, the package's Quad ramp not only lets you paint with a four-way gradient fill, it does double duty as a responsive color mixer. Anyone who has struggled because of the lack of palette management tools in most 24-bit programs will be thrilled with Cricket's drag-and-drop ability to move colors to and from the palette. Finally, artists will love the ability to simulate the look of traditional painting media. Transparency and texture settings can reproduce layers of watercolor, or the granular surface of charcoal.

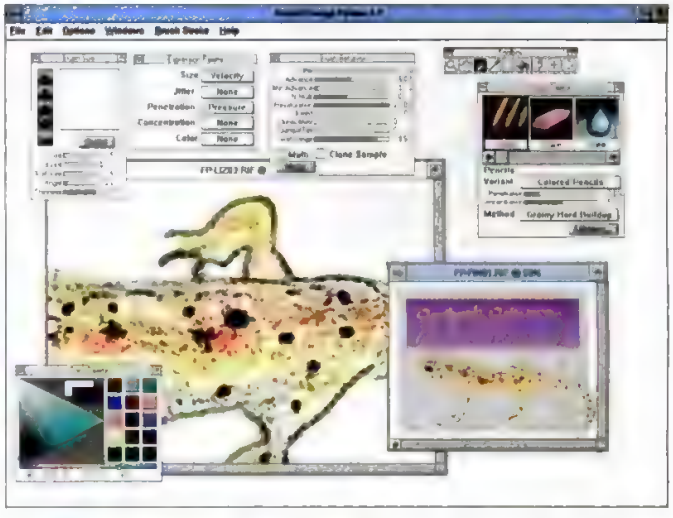
The creative process has always been one of vision and revision. With equally strong painting and editing functions, CA-Cricket Paint gives you the tools you need to accomplish both tasks.

Fractal Design Corp.

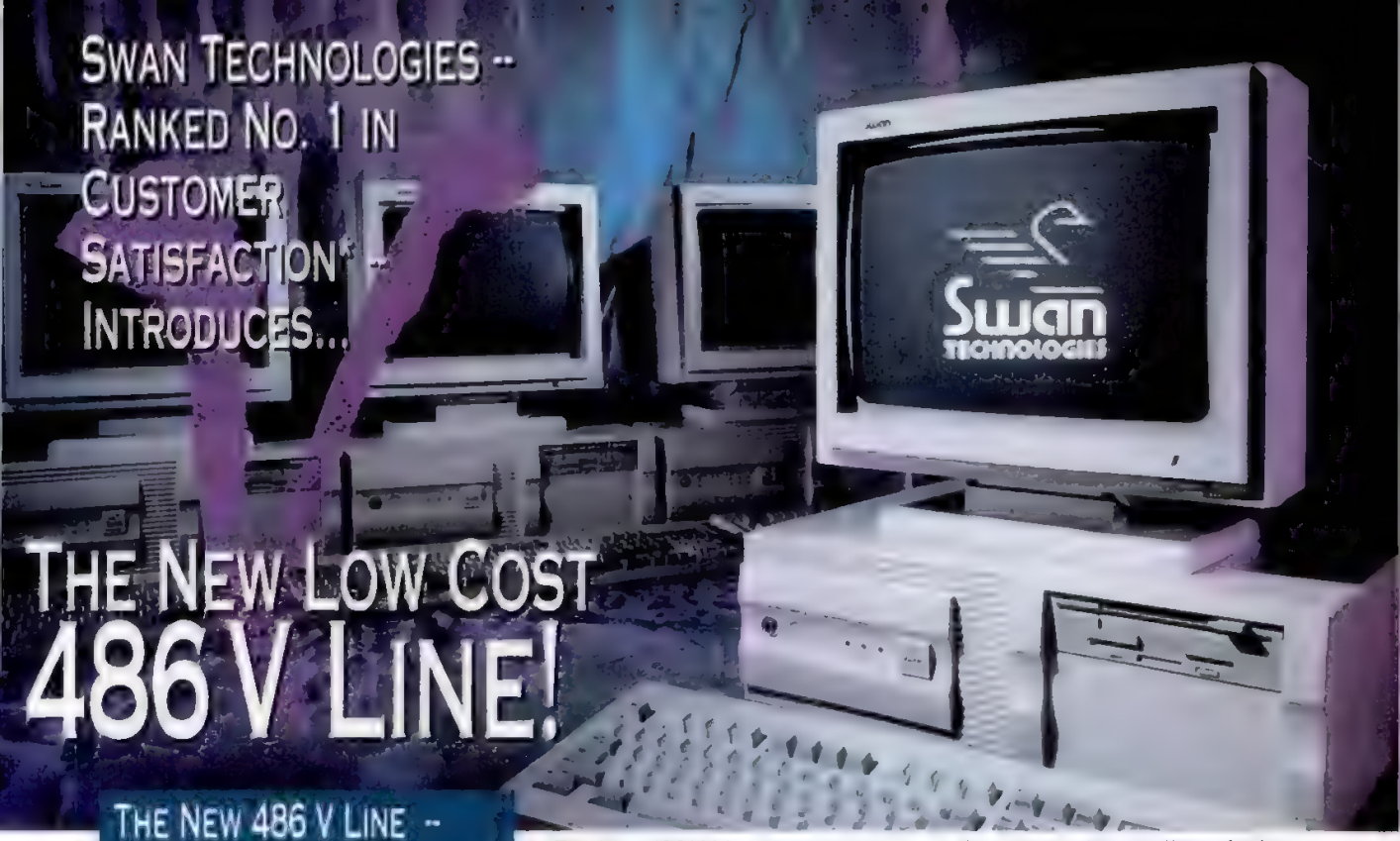
Fractal Design Painter for Windows, Version 1.2

Fractal Design Painter for Windows is a revolutionary graphics program. This $399 painting product doesn't merely simulate the appearance of watercolors or pencil sketches, it actually mimics the behavior of traditional media. If you can do it in real life, you can do it in Painter.

On the simplest level, this means that you can choose a tool from the Brush Palette and a texture from the Paper Palette and begin to paint. The 13 tools include oil paints, chalk, pencils, charcoal, felt-tip markers, pen and ink, colored pencils, crayons, and an airbrush. Remarkably, each of these electronic brushes can match their conventional counterparts stroke for stroke. So when you draw with a pencil you can be sure that the texture



Creating specific effects with Fractal Design Painter (such as the expressive pencil line shown here) is as simple as choosing a tool from the Brush Palette.



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*PC Magazine, Service and Reliability Survey - September 11, 1990
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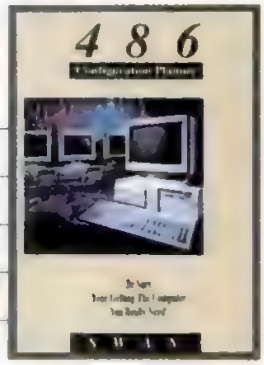

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of the paper will show through. In the same way, the natural variation within each watercolor brush stroke results when wet paint collects along one edge of the brush.

Achieving these effects is no small task. Painter must calculate the behavior of each brush, its interaction with the paper texture (using sophisticated algorithms based on fractal geometry), and

This image, by Chelsea Sammel, shows brush strokes available in Fractal Design Painter, and how they can be used to mimic traditional painting media.

the impact of the current color, along with the direction, speed, and pressure of the stylus, before it can paint a stroke.

Painter uses souped-up Windows drivers for the Wacom tablet; during our testing we were especially impressed by Painter's ability to interpret even minor pressure changes. The smooth brush strokes correctly mapped everything from light touches to heavy pressure.

Many critics have noted Painter's hefty memory requirement (6MB) and sometimes slow performance. On our powerful test-bed, equipped with 16MB of RAM, most of the painting tools were immediately responsive. (If you are running Windows 3.0, you'll have to pay more attention to SMARTDRV and swap file settings than with Version 3.1.) But when using complex brushes—such as the watercolor tool—Painter still drew a dotted line first, and then displayed the brush stroke after a few seconds of processing. This method allows the program to preserve the integrity of each stroke while it completes its computations.

Most artists will be content to experiment with Painter's predefined brushes and papers. The program ships with 48 different paper textures, and each brush

▶ SUMMARY OF FEATURES

24-Bit Paint Programs

Products listed in alphabetical order

■ = YES □ = NO

	CA-Cricket Paint	Fractal Design Painter for Windows	Tempra Pro
List price	$595	$399	$695
Operating environment	Windows	Windows	DOS
General Features			
Total memory required	2MB	6MB	640K
Vendor-tested 24-bit graphics adapters	Diamond SpeedStar 24, Opta MonaLisa	Matrox Impression, Opta MonaLisa	Diamond SpeedStar 24, Genoa 7900, Truevision Targa Plus
Paint beyond window boundary	■	■	□
Multiple open windows	■	■	□
Clipboard	■	■	□
File interchange (reads/writes):			
.BMP (DIB)	■■	■■	■■
EPS	□■*	□□	□■
.GIF	□□	□□	■■
JPEG	■■	□□	□□
.PCX	□□	■■	■■
PICT (Macintosh)	□□	■■	□□
.TGA	□□	■■	■■
TIFF	■■	■■	■■
.WMF	■■ (writes only bitmapped .WMF)	□□	□□
Painting Tools			
Simulated brush effects:			
Airbrush	■	■	■
Chalk and charcoal	■**	■	□
Crayons and felt-tip pens	■**	■	□
Oil brush/Watercolor brush	■**■**	■■	□□
Pen and ink/Pencils	■**■**	■■	■□
Stamp	■	□	■
Edit brush shape/Save brush	■□	■■	■□
Brush controls:			
Calligraphic line	□	■	□
Diffusion/Rate of flow	■□	□■	□□
Fill by color similarity	■	■	■
Gradient fills:			
Rectangular	■	□	□
Specify multiple colors	■	□	■
Choose angle (linear fill)	■□	■■	■■
Choose center (radial fill)	■□	□□	■■
Geometric shapes:			
Arcs	□	□	■
Circles and ellipses	■	■ (via frisket)	■
Freehand/Spline curves	■■	□□	■■
Polylines/Polygons	■■	□■ (via frisket)	■■
Shape controls:			
Diffusion	■	N/A	□
Thickness	■	N/A	□
Blend and smudge	■	■	□

N/A—Not applicable The product does not have this feature
* Via Microsoft Windows drivers. ** Using texture and transparency settings

CONTINUES

type has associated variants, so you can choose among four types of felt pens (such as fine-tip or dirty markers) and five versions of a pencil (such as colored or soft lead). You can easily change the size of the paper grain and adjust its absorbency or the opacity of the ink.

More ambitious users will want to delve into the program's advanced customization features. The Methods menu determines how ink will be applied to the page and allows you to alter the nature of a brush. For example, switching from the Grainy Wet Buildup method to Grainy Hard Cover makes a watercolor brush behave like a pencil.

ESOTERIC BUT EXTRAORDINARY

Other parameters that define a brush include Expression, Size, and Behavior. These functions are hidden away in separate palettes and can be tough to understand. These esoteric controls, however, are what allow Painter to create complex and extraordinary brushes. For example, the N Multi setting within the Brush Behavior palette gives the Van Gogh tool the ability to imitate the tactile painting style of the famous post-impressionist by generating multifaceted brush strokes. Of course, you can save your modifications to a new brush or a brush variant.

PC Magazine Labs' testing script, which included text insertion and cut-and-paste operations, revealed Painter's weaknesses. A total lack of text support forced us to use a calligraphy brush to

▶ FACT FILE

Fractal Design Painter for Windows, Version 1.2

Fractal Design Corp., 335 Spreckels Dr., Suite F, Aptos, CA 95003; 408-688-8800; fax, 408-688-8836

List price: $399.

Requires: 386-based PC or better, 6MB RAM, Microsoft Windows 3.*x*, 8-bit graphics adapter (16 bit graphics adapter or better recommended), mouse or digitizing tablet

In short: For pure artistic expression, Fractal Design Painter for Windows is the program of choice. Despite its low price of $399, Painter is an elegant program that mimics the behavior of traditional media, such as oil paints, watercolors, airbrushing, and charcoal.

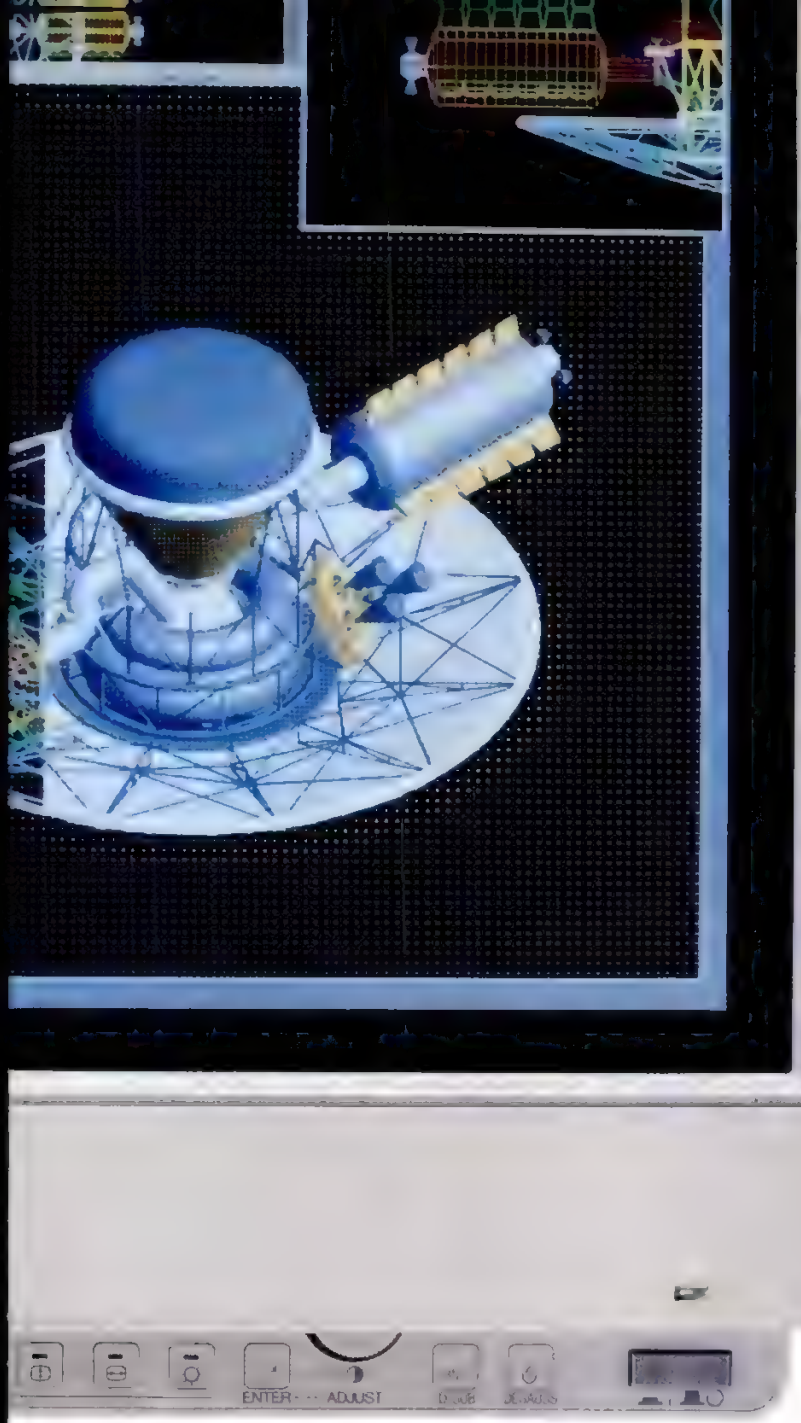
473 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

Products listed in alphabetical order ■ = YES □ = NO	CA-Cricket Paint	Fractal Design Painter for Windows	Tempra Pro
Painting Tools (continued)			
Set transparency and feather while cloning	■	■	□
Work in individual channel	Hue only, value only, RGB	None	Hue only
Patterns and textures	5 pattern functions, 3 texture types	48 paper textures	None
Text Handling			
Font support	Any font via Windows type scaler	None	15 supplied Bitstream bitmapped fonts
Anti-aliasing	■	N/A	■
Cut, copy, and paste as text	■	N/A	□
Size/Style	■■	N/A	□□
Rotate text	□	N/A	■
Image-Editing Tools			
Selection tools:			
Mask type	Bitmapped (8-bit)	Vector	Bitmapped (1-bit)
Select by color (magic wand)	■	□	□
Select line of pixels	□	□	■
Protect colors	■	□	■
Paste into selection/to brush	■■	□□	□■
Crop/Duplicate selection	■■	□■	□□
Feather edges	■	■	□
Eraser	■	■	□
Flip and mirror	■	□	■
Color models supported	HSV, RGB	HSV	CMY, HLS, HSV, RGB
Color selection method	Color picker, color editor	Color picker	Color picker, color editor
Scaling	■	□	■
Image processing:			
Global anti-aliasing	□	□	■
Blur, soften, and sharpen	■	□	■
Emboss	■	□	■
Alter saturation	■	■	□
Tint and wash	□	□	■
Device Support			
Digitizers	Wacom	CalComp, Wacom	None
Supports pressure sensitivity	■	■	N/A
Film recorders	Windows-compatible	Windows-compatible	None
Frame grabbers and scanners	□	□	■
Printers	Windows-compatible	Windows-compatible	Most popular printers
Print options:			
Fit to page/position	■□	□□	□■
Print selected area	□	■	□
User-specified dither pattern	■	□	□
User-specified margins	■	□	□
User-specified size	■	□	■
User-specified resolution	□	■	□
Documentation and Support			
On-line help	■	■	□
Technical support (eastern time)	9:00–8:00 M–F	11:00–8:00 M–F	9:00–5:00 M–F
BBS	CompuServe	None	CompuServe

N/A—Not applicable The product does not have this feature

ENDS



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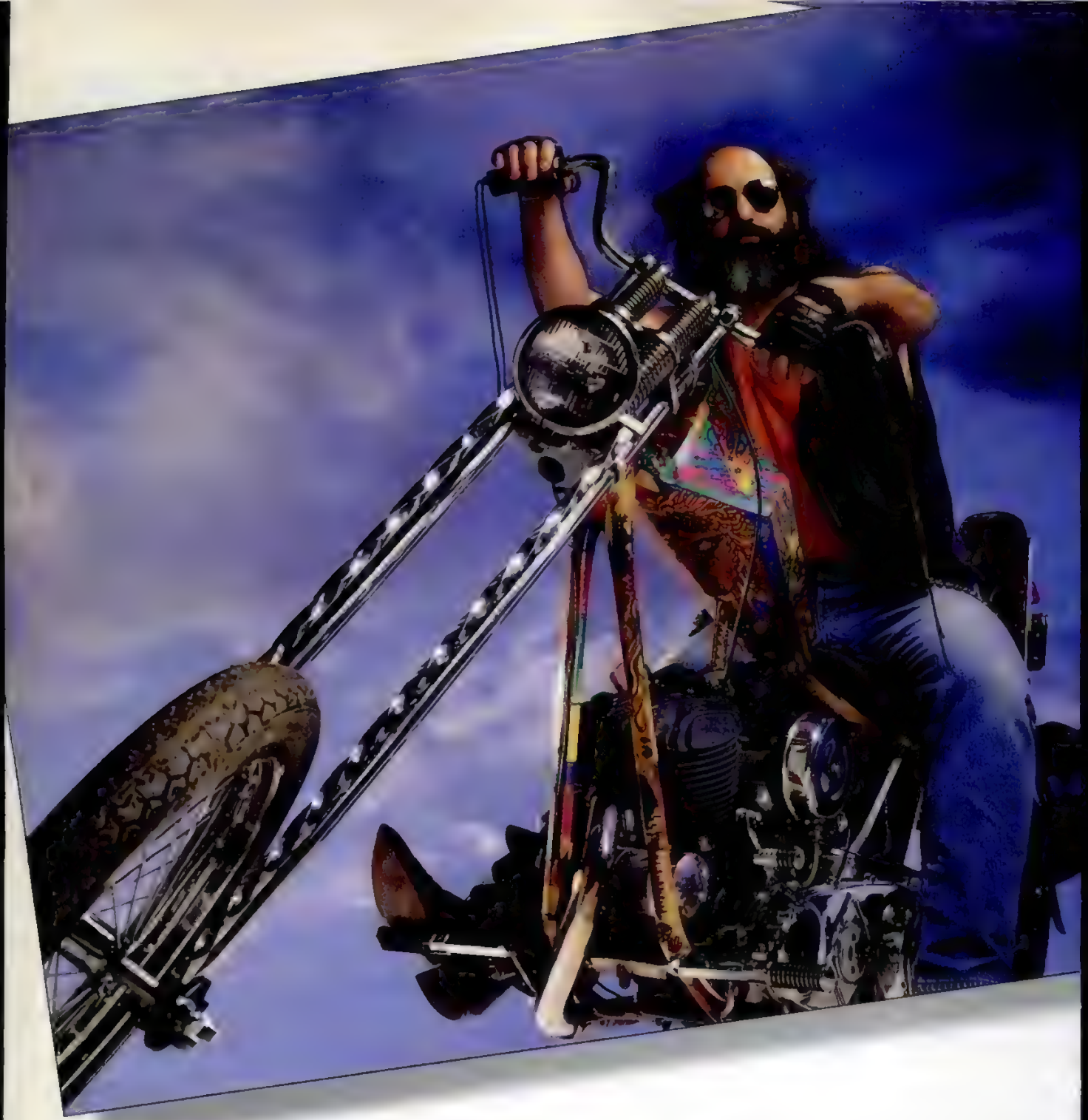
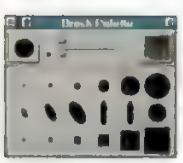
CIRCLE 283 ON READER SERVICE CARD





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CIRCLE 247 ON READER SERVICE CARD

draw the company logo in our test image. The rectangular selection marquee made it impossible to clip the irregularly shaped mascot to a new picture without picking up unwanted background. Even creating something as simple as the rectangular backdrop for the logo required that we first use the selection marquee or predefined friskets (masks), because Painter cannot draw simple geometric shapes directly.

Painter's powerful cloning feature proved to be the solution to all of these problems. We used the cloning tools to combine the background, logo, and lizard images. These tools also allow you to transform images to a completely different artistic style—converting photographic images to oil paints, for example.

Despite their power and flexibility, Painter's cloning techniques are labor-intensive: You must paint each brush stroke to create the copy. You can record and then play back a single brush stroke or invoke the automatic cloning function to save yourself some work. However, the repetitive nature of these tools limits their usefulness.

Indeed, many of the automated functions that artists have come to expect from a painting program require extra elbow grease in Painter. For example, Painter does contain a blur function, but because it is implemented as the Water tool, you must still paint each brush stroke.

Likewise, the program's lack of standard image-editing functions will force you to develop workarounds. For instance, though you can't control the transparency of a paste operation, you can use the Fade command to undo a deletion partially. And instead of allowing you to mix a color easily, the package forces you to scroll through the HSV model to pick hues from the full-color but noneditable palette.

Painter does allow you to adjust brightness and contrast and apply a surface texture to an image. But if you want special-effect filters such as embossing, you'll have to rely on the program's support of Aldus's Plug-In technology. When installed in Painter's subdirectory, the first volume of Aldus Gallery Effects, Classic Art, will add 18 different effects to Painter's Edit menu.

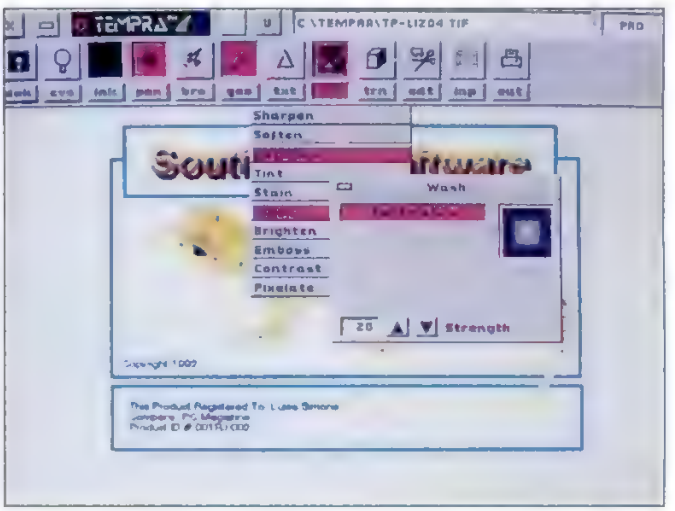
Despite Painter's price, Fractal Design has set its sights on the high end of the graphics market. The program reads and writes several file formats, including .BMP, .PCX, Targa, and TIFF, but the data must be stored as 24-bit, RGB values—no indexed palettes or CYMK colors. Painter also supports bitmapped PICT, Macintosh TIFF, and RIFF, a proprietary cross-platform format.

Contradictory random-yet-structured behavior is the hallmark of a fractal algorithm. Like the mathematical theorems on which it is based, Fractal Design Painter for Windows offers artists both a high degree of control and a high level of spontaneity. Its fluid and expressive painting functions make it an indispensable tool for users who want to produce professional-quality illustrations or expand their creativity.

Mathematica Inc.

Tempra Pro, Version 3.0

Mathematica bills Tempra Pro ($695) as a low-cost, high-performance paint program. And when this statement is viewed in a historical context, there is no disputing its truth. When Tempra Pro was first released, it was the only 24-bit paint program for the PC priced at less than $1,000. But the times are changing, and this DOS-based product has not kept pace with the competition, either in features or in price.



Although you can see Tempra Pro's cascading menus and the current image simultaneously, you cannot paint until you remove the menus from the screen.

Don't misunderstand: Tempra Pro offers some interesting features. It is the only program in our roundup that can handle image aquisition. Like Time Arts' Lumena and Truevision's TIPS, both of which are also DOS-based but are higher in price, Tempra Pro can drive scanners and capture frames from video sources. And as a DOS program, Tempra Pro has less overhead than its Microsoft Windows–based competitors. As a result, Tempra Pro has the least stringent hardware requirements. A 286 processor, 640K of RAM, and a VGA adapter are all you need to run the program, though not enough to get great performance. On our test-bed, which included a 486 processor, 16MB of RAM, and a 24-bit adapter, Tempra Pro was much faster than the other packages.

A series of 12 cascading menus lets you access all of Tempra Pro's functions. Among the program's features are pen and brush shapes, ink choices, text functions, built-in filters, and editing commands. Tempra Pro's power lies in its ability to configure and combine these basic functions into sophisticated painting tools. For example, it offers six preset profiles for the airbrush but also allows you to control the size, shape, and density of the brush. Even more impressive is that you can use the rectangular geometry function, a pattern fill, and the Wash filter simultaneously to create a transparent overlay of any pattern.

Tempra's geometry functions are a distinguishing characteristic of the program. While most raster paint programs let you choose between filled or unfilled geometric shapes, Tempra Pro allows you to create complex shapes and patterns easily. For example, by invoking the fixed-point and repeat options, you can use the Line tool to generate radiating fans or starbursts.

DESIGN DECISIONS

Unfortunately, digging deeper reveals that many functions are poorly imple-

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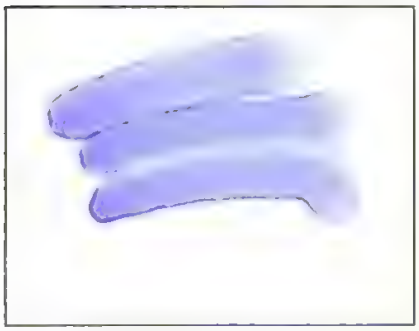
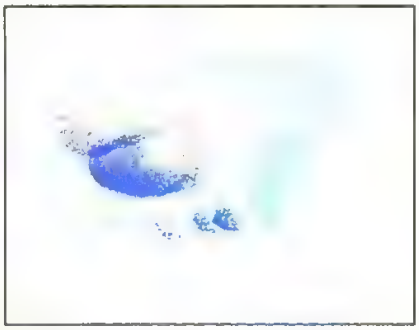
Profile of a Brush

While you consciously react to the colors in a painting, the brush work is what moves you on an emotional level. We take a look at how to produce various brush strokes with CA-Cricket Paint, Fractal Design Painter, and Mathematica's Tempra Pro.



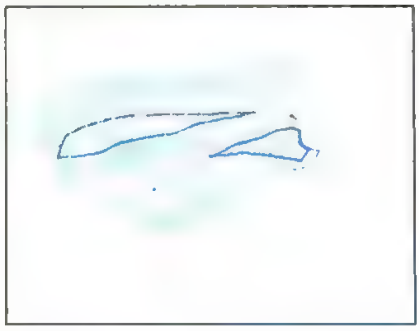
Fractal Design Painter

Over 14 settings in 4 floating palettes affect Painter's *watercolor* brush. Wet Fringe determines how much water and pigment collect along the edge of a stroke before the paint dries, and the Bleed setting allows the brush to reabsorb pigment. Watercolor pigment uses the Grainy Wet Build Up method, which lets paper texture influence brush strokes and increases the color density of overlapping strokes.



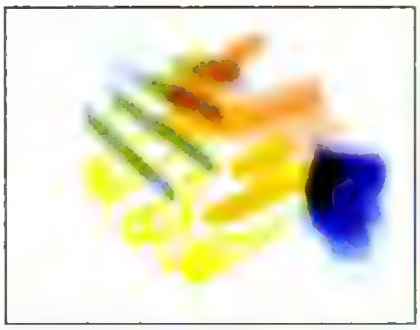
CA-Cricket Paint

You can simulate paper grain in CA-Cricket Paint with a texture setting. This example uses a Sandy setting of 14. With opacity at only 38 percent, we were able to preserve the feel of translucent, overlapping brush strokes. The four source colors in a Quad Ramp provide the pigment variation typical of *watercolors*. We used the filled Area tool in conjunction with the Freeform shape to draw the irregular outline of each brush stroke.



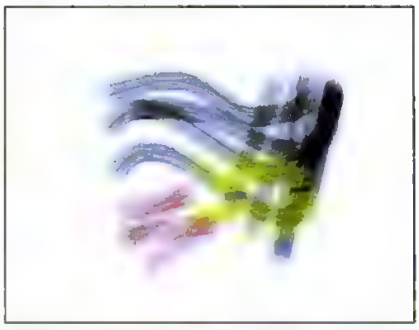
Tempra Pro

You use the Wash filter to simulate *watercolor* washes with Tempra Pro. Here a 20 percent Wash with the Continuous option toggled on allowed us to apply several layers of paint to mimic overlapping brush strokes. Tempra Pro doesn't offer any free-form closed-curve tools, so we created the brush stroke shape by using the Filled Irregular Polygon geometry setting. We used tiny line segments to simulate curves for the stroke outlines.



The key to the behavior of Painter's *Dirty Markers* lies in the Resaturation and Bleed settings. A Resat value of 42 percent guarantees that the flow of ink will continue steadily no matter how long or flowing your strokes—just like a real felt-tip pen. Here a Bleed setting of 65 percent works with dry paper and determines the way that complementary colors will contaminate one another, producing dark or dirty—but realistic—results. The Cover Method is Soft Variable Build Up; *Soft* refers to anti-aliased edges.

CA-Cricket Paint's Texture dialog box is essential for mimicking *chalk* or *charcoal*. A Sandy setting of 4 simulates fairly smooth paper, and a Dots setting of 80 percent creates a so-called "scumbled" effect, in which a small amount of paper shows through the nearly solid chalk lines. The effect is believable because both Dots and Sandy create random patterns of pixels. Since chalk is nearly opaque and mixes ever so slightly with paper, we used an anti-aliased brush (Smooth Edges at 167) at 95 percent opacity.



Because *crayons* are dry, they leave a textured or "scumbled" mark on paper. But the only way to paint with texture in Tempra Pro is to alter the shape of the brush, using the fat-bit editor. Even though we tried to create a random pattern, the texture is repeated regularly and looks stiff and mechanical. We used the Spline Geometry option to create a series of curved lines. Anti-aliasing was turned off to re-create the rough edge of a typical low-resolution crayon.

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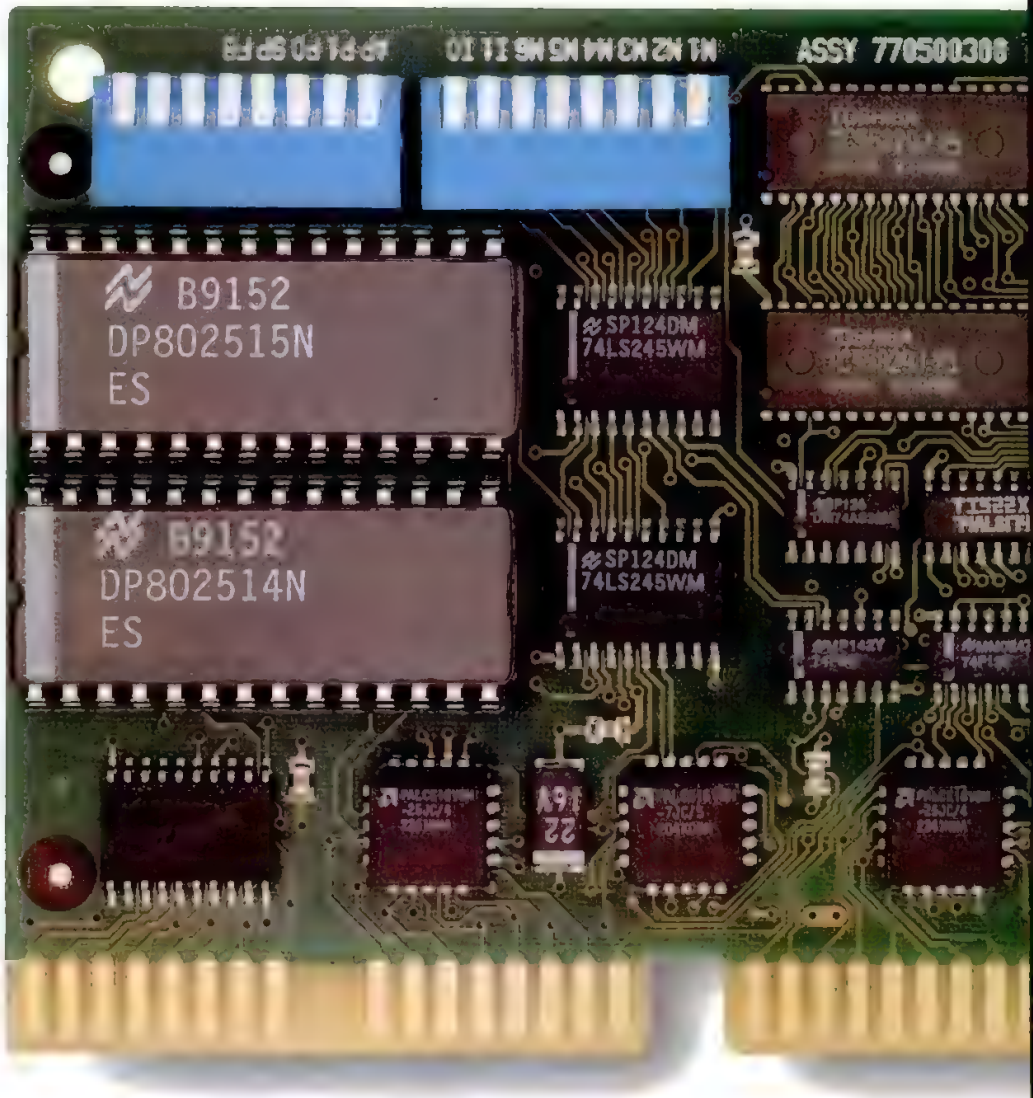

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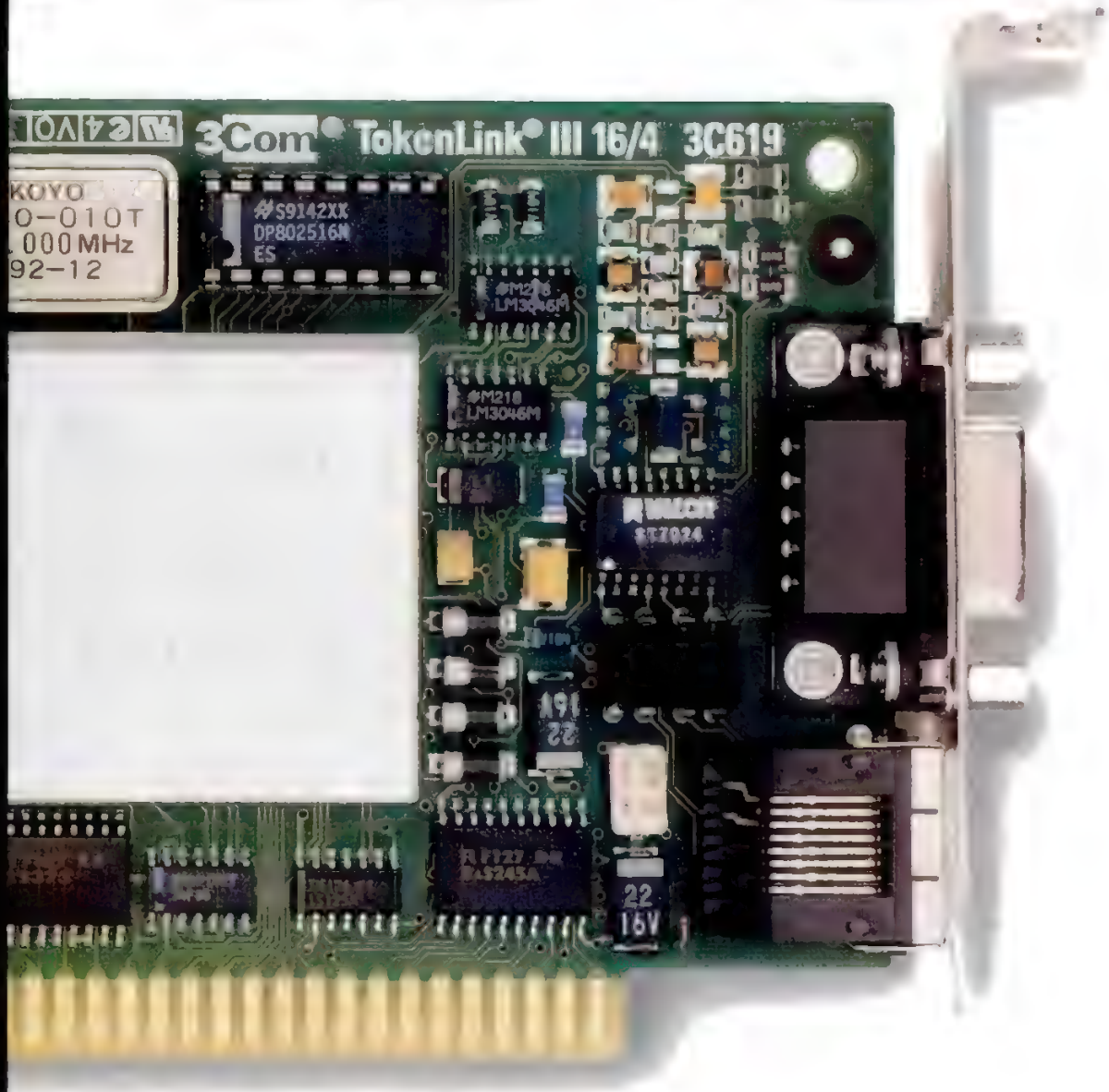

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This image was created by Judy Armstrong in Tempra Pro by using scanned-in photographs of plants, leaves, and natural textures, as well as some of the package's paint tools.

mented. At first glance, it is convenient to choose one of eight different pen nibs. But to create a custom shape you must work in an old-fashioned fat-bit editor. This limits you to a 16-by-16 pixel matrix and results in either strictly geometric or stilted pen strokes.

Masking exhibits the same kinds of shortcomings. It's great to define a mask either as an area or on the basis of color similarity. But even though Tempra Pro uses a bitmapped mask plane, the program cannot vary the opacity of a mask, making something as simple as a feathered edge difficult to achieve. And to our chagrin we discovered that while a mask is active, the Undo function is arbitrarily disabled.

These problems are not bugs; they are just the way Tempra works. To use a gradient fill you must tediously define a series of color slots in the program's 256-color palette. This is a vestige from the days of indexed palettes and has no place in a program that claims to support 24-bit painting functions. Other anachronisms include fixed-point, bitmapped fonts and a zoom function that is really just a fat-bit editing window.

PC Magazine Labs' testing script includes tasks designed to evaluate a program's painting, image-editing, and text tools. As a creative painting program, Tempra Pro was inflexible and unresponsive, especially when compared with the two other programs in this roundup. For example, Tempra Pro does not support any pressure-sensitive input devices. When we attempted to simulate subtly shaded brush strokes (by using the density and opacity settings in the Airbrush and Wash configuration dialog boxes), we found Tempra Pro poorly differentiated any values over 50 percent.

Perhaps most frustrating is the program's insistence that all menus be hidden before you can paint. One useful keyboard shortcut allows you to change the current color without returning to the menus. There is a woeful shortage of keyboard shortcuts to switch tools or invoke dialog boxes, however. As a result, you will find yourself constantly shuttling between the canvas and the menus.

In fairness to Tempra Pro, it should be noted that the program had no difficulty with text insertion or cut-and-paste operations. Adding a drop shadow behind the bitmapped text was as simple as clicking the appropriate option in the Font Settings dialog box. And Tempra Pro's clipping box made it possible to combine the various elements of the design. Unlike a true clipboard, though, Tempra Pro requires you to go through an extra step and save clippings to disk if you want to cut and paste images between two or more files. The clipping box provides several essential editing functions—in the form of icons—including the ability to scale, rotate, and flip the current selection. The paintbrush icon, which allowed us to use the clipping as a brush, and the Edge Blend icon, which toggles anti-aliasing on and off, proved invaluable during testing.

Unfortunately, our testing was fraught with difficulties. For example, we had to match our graphics adapter to Tempra Pro's supplied drivers, since it is a DOS program. The Genoa 7900 we used allowed us to operate Tempra Pro in 24-bit mode at a resolution of 640 by 480. We were surprised to find that we could not print to a color PostScript device, because Version 3.0 of Tempra Pro shipped with a faulty driver. Mathematica has an updated color PostScript driver, but it was not available in time for this review. Finally, we could not import our background picture of sand into our Tempra Pro document, because Tempra does not support many varieties of LZW-compressed TIFF files. Tempra does read and write a number of different file formats but inexplicably uses the Packbits compression scheme for color as well as black-and-white images.

If your images are part of a larger multimedia project, you should note Tempra Pro's ability to handle IBM's Audio Visual file format, as well as the ability of the bundled companion program, Tempra Show, to provide multimedia authoring functions. An ancillary program—the $295 Tempra Turbo Animator—allows you to edit and create animations using the .FLI and .FLC formats. Mathematica also offers a 256-color version of Tempra Pro called Tempra GIF ($149).

Mathematica is currently working on a Windows version of Tempra Pro. When it ships, this new product will take advantage of a 32-bit environment and should offer dramatically improved painting functions. In the meantime, you should buy Tempra Pro only if you won't upgrade to a 386 processor, hate Windows, and can't afford Lumena. Tempra Pro will allow you to create, scan, and edit 24-bit images. But with arbitrarily limited functions and erratic performance, it isn't going to be easy. □

FACT FILE

Tempra Pro, Version 3.0

Mathematica Inc., 402 S. Kentucky Ave., Lakeland, FL 33801; 800-852-6284, 813-682-1128; fax, 813-686-5969

List price: $695

Requires: 286-based PC or better, 640K RAM, VGA graphics adapter, DOS 3.0 or later, mouse. 386-based PC or better, 2MB RAM, 8-bit graphics adapter or better recommended

In short: Tempra Pro's high price does not guarantee higher performance. Anachronisms such as fat-bit editing windows and palette-based gradient fills reveal this product's old-fashioned approach to image creation. Image acquisition (in the form of drivers for scanners and video-capture boards) as well as strong geometry drawing functions distinguish Tempra Pro from the competition but do not sufficiently compensate for the program's weaknesses

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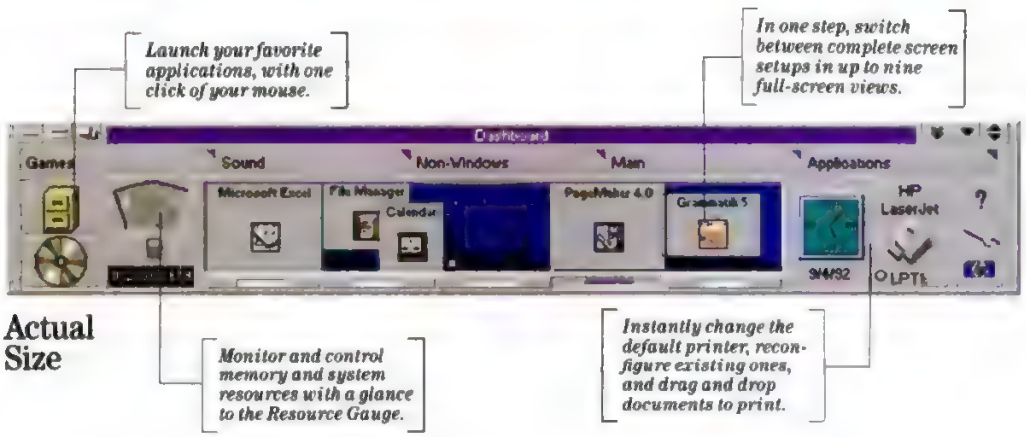

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Pausing CONFIG.SYS

Extend the Rename Command

BY NEIL J. RUBENKING

PAUSING CONFIG.SYS

Tom R. Donnelly had a great idea when he wrote ALTPAUSE.COM, published in the February 11, 1992, column. I immediately typed in the DEBUG script, produced the program, and spread it liberally throughout my AUTOEXEC.BAT. It worked so well that I used the same technique—a pause while a Shift key is pressed—in a device driver I created called ALTPAUSE.SYS. The driver produces the same effect in CONFIG.SYS files as ALTPAUSE.COM does in batch files.

To create ALTPAUSE.SYS, use the DEBUG script in Figure 1. And to use ALTPAUSE, just insert it in your CONFIG.SYS file with this line:

```
DEVICE=ALTPAUSE.SYS
```

When loading a device driver, DOS tells it to initialize itself. Other than specific actions required of a driver, all ALTPAUSE.SYS does is test the shift-state byte until it finds no Shift key pressed, the same way ALTPAUSE .COM does.

When ALTPAUSE finds that no Shift key is pressed, it disappears without a trace by giving back all the memory DOS allocated to it and telling DOS that it failed. DOS loads the next device driver in the same place, thus no memory is squandered.

R. S. Fleischmann
Delta, Pennsylvania

ALTPAUSE.SCR

Complete Listing

```
A100
DB FF FF FF FF 00 80 16 00 21 00
DB "ALTPAUSE"
DB 00 00 00 00
CS:
MOV     [0012],BX
CS:
MOV     [0014],ES
RETF
PUSH    DS
PUSH    ES
PUSH    AX
PUSH    BX
MOV     AX,0040
MOV     DS,AX
TEST    BYTE PTR [0017],0F
JNZ     012A
CS:
MOV     BX,[0012]
CS:
MOV     ES,[0014]
ES:
MOV     WORD PTR [BX+03],0100
ES:
MOV     WORD PTR [BX+0E],0000
ES:
MOV     [BX+10],CS
MOV     WORD PTR [0004],0000
MOV     BYTE PTR [000A],00
POP     BX
POP     AX
POP     ES
POP     DS
RETF

RCX
5B
NALTPAUSE.SYS
W
Q
```

Figure 1: **This DEBUG script creates ALTPAUSE.SYS, a device driver that pauses the execution of your CONFIG.SYS for as long as you hold down a Shift key.**

▶**PC MAGAZINE** Sometimes messages from the device drivers in your CONFIG.SYS file just whiz past too quickly. Did your peripheral vision detect the word *error* on the screen? ALTPAUSE.SYS lets you stop the action long enough to see what's going on, just as ALTPAUSE.COM does in AUTOEXEC.BAT. You can load it in CONFIG.SYS multiple times, perhaps after every driver that produces screen output—it won't take up any memory. Do note that you shouldn't start holding down a Shift key until just before the CONFIG.SYS processing begins: In many cases the BIOS will report a keyboard error if you're holding down a key during the Power On Self Test.

To create ALTPAUSE.SYS, type the listing in Figure 1 into the file ALTPAUSE.SCR, or download the self-extracting archive ALTPAU.EXE from PC Magnet. Enter the command

```
DEBUG < ALTPAUSE.SCR >
 ALTPAUSE.LOG
```

then scan the LOG file for any occurrences of DEBUG's Error message. If no errors were reported, ALTPAUSE.SYS was created successfully.

EXTENDING THE RENAME COMMAND

It's easy to rename a single file, and it's just as easy to rename a large group of files, assuming you want to cut the names from the end. For example

```
ren A*.* A???.*
```

shortens all filenames that begin with A to their first four characters.

Unfortunately, I needed to shorten a group of filenames beginning from the left. I'd been working with 16 files, CHAPT1.TXT, CHAPT2.TXT, and so on, and decided it would be easier if I renamed the files to the number alone and got rid of the extension. This was not so easy. First I tried the command

```
ren CHAPT*.TXT *.
```

with no effect except an error message. This is because the * in the second argument of the REN command corresponds not to the * in the first argument but to

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the whole filename. Using ?s instead of *s didn't work either. In fact, my experiments showed that there's no way to move any character in a filename using wildcards in arguments to the REN or COPY commands.

Finally, I designed the batch file CUTBEG.BAT. Its first argument specifies the files to rename; it may include wildcards but not path or drive specifications. The second argument is the number of characters to delete, 1 to 7.

The main idea in CUTBEG is that the construction %NAME% used in batch file commands *disappears* if the NAME does not exist as an environment variable. By building such a nonexistent environment variable into the filename in the batch file, you can shorten the filename. To use this technique, CUTBEG generates a new temporary batch file containing all the necessary REN commands. I also used the idea of an "assigned goto" command I found in Roger Crowley's User-to-User submission in the October 31, 1989, issue.

The full listing of CUTBEG.BAT appears in Figure 2. The fourth line transfers control to one of the labels :1 through :7 depending on the second argument (the number of characters to delete) in order to set up arguments for further processing. To do this processing, CUTBEG is run again with the necessary arguments. The %0 parameter is replaced with the name of the batch file itself, so any lines beginning with %0 run CUTBEG again.

The %2 parameter, which will become the goto address, is specified as *begin*. Thus, on the second run, the fourth line transfers control to the label :begin. The lines that follow constitute the main part of the procedure for deleting leading characters. The renaming proceeds in two stages. First, all files matching the file specification in the first parameter are renamed to replace *n* leading characters in their names with a string consisting of *n*-1 @ characters and a single % character. The substituted string is referenced here as %4, the fourth argument of the calls to CUTBEG in the lines beginning with %0. (Remember that to represent a single % in a batch file, you need to use %%.) Then these spurious leading characters are deleted from all the filenames containing them.

CUTBEG.BAT

Complete Listing

```
echo off
rem Usage: CUTBEG filespec n
rem Delete first n chars from file names of filespec, n=1..7
goto %2
:1
%0 %1 begin @       %%       %%0
:2
%0 %1 begin @@      @%%      %%0
:3
%0 %1 begin @@@     @@%%     %%0
:4
%0 %1 begin @@@@    @@@%%    %%0
:5
%0 %1 begin @@@@@   @@@@%%   %%0
:6
%0 %1 begin @@@@@@  @@@@@%%  %%0
:7
%0 %1 begin @@@@@@@ @@@@@@%% %%0
:begin
if NOT exist %4*.* goto cont
echo Sorry, this procedure can't work due to presence of %4*.* files.
echo    Please, rename them some way and try again.
goto end
:cont
ren %1 %4*.*
if exist CUTBEG1.BAT del CUTBEG1.BAT
set %3=
for %%f in (%4*.*) do echo ren %4%%5%%f %5%%f>>CUTBEG1.BAT
echo %0 A del>>CUTBEG1.BAT
CUTBEG1
:del
del CUTBEG1.BAT
:end
```

***Figure 2:* This batch file uses only standard DOS commands to cut one to seven characters from the beginning of a group of filenames.**

To avoid renaming the wrong files, CUTBEG first tests that no files containing these characters in their names exist in the current directory. Since all the files CUTBEG creates will have a percent sign in their names, it's unlikely they will exist in an ordinary directory (though you could end up with some if you abort execution of the batch file).

To be sure that the environment variable referenced as %3 disappears, its value is cleared with the command SET %3= so you want a name unlikely to be used normally as an environment variable. In the lines that call CUTBEG.BAT a second time, the third argument is specified as a sequence of @s.

The FOR loop generates the necessary renaming commands for the second stage and places them into the temporary batch file CUTBEG1.BAT. The line following the FOR loop places a command at the end of CUTBEG1.BAT to transfer to CUTBEG again, with the second parameter equal to DEL, so that CUTBEG.BAT will run a third time and delete CUTBEG1.

The problem of renaming the files CHAPT1.TXT, CHAPT2.TXT, and so on to something such as 1, 2, and 3 can now be solved with two commands. Delete the extensions and then apply CUTBEG:

```
ren CHAPT*.TXT CHAPT*
CUTBEG CHAPT* 5
```

If you want to change the filenames back to their original names, it's a simple exercise with the FOR command. Assuming there are no other files without extensions in your directory, just type

```
for %f in (*) do ren %f
 CHAPT%f.TXT
```

CUTBEG.BAT doesn't work if after the intended renaming a collision of filenames should occur. In such a case an error message is issued in the course of the first renaming, and that renaming stops in the middle. As a result, some files might be properly renamed while others retain their original names. Note also that if you try to delete too many characters from some filenames (such as deleting three characters from ABC.TXT), the files will be partially renamed, with

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CIRCLE 353 ON READER SERVICE CARD

CUTB.BAT

Complete Listing

```
@ECHO OFF
IF '%2'=='' GOTO syntax
IF '%2'=='again' GOTO SecondRound
IF EXIST ERROR.LOG DEL ERROR.LOG
REM *** To cut "n" characters from a filename, copy it starting
REM *** at character number n+1
STRINGS start=ADD %2,1
REM *** Call CUTB again for each matching file
FOR %%f IN (%1) DO CALL %0 %%f again
REM *** Clear the environment variables we used
SET start=SET nam=SET nam2=SET ext=
IF NOT EXIST ERROR.LOG GOTO done
REM *** Display the log of errors.
MORE < ERROR.LOG
GOTO done
:SecondRound
REM *** Here begins the code that gets executed for
REM *** each filename that matches the template. First,
REM *** split it into name and extension.
STRINGS nam=FILENAME %1
STRINGS ext=FILEEXT %1
REM *** Don't shorten our ERROR.LOG!
IF '%nam%.%ext%'=='ERROR.LOG' GOTO done
IF EXIST %nam%.%ext% GOTO IsHere
REM *** If the file isn't in the current directory,
REM *** report the error and quit.
ECHO File %nam%.%ext% not in current directory >> ERROR.LOG
GOTO done
:IsHere
SET nam2=
STRINGS nam2=MID %nam%,%start%,8
REM *** If the name is long enough, variable nam2 will
REM *** be non-null. Otherwise, report the error.
IF NOT '%nam2%'=='' GOTO OkLen
ECHO Cannot shorten %nam%.%ext% >> ERROR.LOG
GOTO done
:OkLen
REM *** If a file already exists with the newly shortened
REM *** name, report the error and skip it.
IF NOT EXIST %nam2%.%ext% GOTO OkName
ECHO Cannot rename %nam%.%ext% to %nam2%.%ext% >> ERROR.LOG
ECHO       because %nam2%.%ext% already exists. >> ERROR.LOG
GOTO done
:OkName
REM *** FINALLY! Perform the shorten-renaming.
REN %nam%.%ext% %nam2%.%ext%
GOTO done
:syntax
ECHO SYNTAX: "CUTB filespec n", where n is from 1 to 7
:done
```

Figure 3: This batch file relies on the *PC Magazine* utility STRINGS.COM to cut one to seven letters from the beginning of a group of filenames.

names like @@. . .%, so that manual correction will be needed.

Andrey B. Khodulev
Moscow, Russia

▶PC MAGAZINE The "disappearing name" technique used in CUTBEG.BAT may require a little more explanation. Let's trace through a very simple call to this batch file, one that removes the first three characters from a single file, SNAFU.DAT. The initial command is

```
CUTBEG SNAFU.DAT 3
```

The batch file transfers control to the label whose name is specified in the second parameter, in this case 3. At that label is the batch line

```
%0 %1 begin @@@     @@%%     %%@
```

The %0 gets replaced by the full pathname of the batch file itself, %1 by the first parameter, and the pairs of percent signs by a single percent sign. After expansion, this line looks like:

```
C:\BAT\CUTBEG SNAFU.DAT begin @@@
 @@% %@
```

When this line is executed, it calls CUTBEG.BAT again. This time the second parameter is begin, so we jump to the label :begin. The first line after this label tests for the existence of files matching the template @@%*.*. If such files already exist, CUTBEG can't work properly, so it prints a message and quits. Otherwise, it renames all files matching the first parameter so that they begin with @@%. In this case, SNAFU.DAT gets renamed to @@%FU.DAT. At this point, a problem *could* arise if another file differing only in the first three characters (say, FRUFU.DAT) were being processed.

Next, the batch file checks for a left over copy of its secondary batch file and deletes it if found. It clears the environment variable whose name is @@@, the third parameter. Now it creates a line to rename each matching file and stores that line in the secondary batch file CUTBEG1.BAT. The line that creates CUTBEG1.BAT is:

```
for %%f in (%4*.*) do echo ren
 %4%%5%%f %5%%f>>CUTBEG1.BAT
```

For each file that matches the template @@%*.*, this command echoes a particular command to the secondary batch file. In this case, there's only one matching file, @@%FU.DAT. After replacing the parameters by their values and the leftover pair of percent signs by a single percent sign, the line sent to CUTBEG1.BAT is:

```
REN @@%%@@@%FU.DAT %@@@%FU.DAT
```

When CUTBEG1.BAT gets executed, this line is subject to expansion yet again. The batch file carefully ensures that the environment variable named @@@ does not exist, so both occurrences of %@@@% simply drop out, replaced by nothing. The pair of percent signs is replaced by a single percent sign, leaving the command:

```
REN @@%FU.DAT FU.DAT
```

What a process to have to go through! But it does achieve the desired effect, relying on nothing but commands that are built into DOS.

For those who don't object to using a *PC Magazine* utility, I wrote a similar batch file, CUTB.BAT, shown in Figure 3. CUTB uses STRINGS.COM (September 10, 1991) and keeps track of any errors in a file called ERROR.LOG. If cutting the beginning from a filename would produce a name collision (as with SOON.BAT and MOON.BAT), CUTB makes a note in the error file. And if a filename is too short for the requested operation (like cutting three characters from FOO.BAR), it also notes that problem. Like CUTBEG, CUTB only works on files that are in the current directory. However, if you pass CUTB a file specification that doesn't refer to the current drive, it detects that fact and reports the error. You can dowload these two handy batch files from the Utilities/Tips forum on PC MagNet. □

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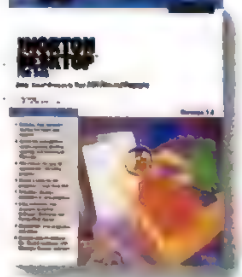

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CIRCLE 186 ON READER SERVICE CARD

TUTOR

Making Windows Scream—Painlessly

BY JEFF PROSISE

Did you buy a 386—maybe even a 486—race horse only to watch Windows 3.1 put it behind a plow? If so, here are ten simple configuration changes you can make. Implementing the proper combination for the type of work you do and your hardware will help you get the most out of your Windows system.

USE SMARTDRIVE Installing SmartDrive (or a similar type of program) is the single most important change you can make to boost Windows' speed. SmartDrive is a disk-caching utility that uses extended memory to buffer data going to and from the disk drives. Version 4.0, shipped with Windows 3.1, works on floppy as well as hard disks. (Version 3.*x*, which came with Windows 3.0 and currently ships with DOS 5.0, caches hard disk data only). The program uses a technique known as *write-behind caching* that can defer disk writes for up to 5 seconds, considerably improving overall drive performance. Windows is disk-intensive, so employing a fast disk cache can produce dramatic performance gains.

To install SmartDrive, simply add the command SMARTDRV, followed by the cache amount (in K), to your AUTOEXEC.BAT file. This differs from earlier versions, which required a DEVICE= statement in your CONFIG.SYS file. `SMARTDRV 2048`, for example, installs SmartDrive with a 2MB cache. No hard and fast rule governs the size you choose; a larger cache gives speedier performance but robs Windows of much-needed RAM. If you're unsure about how much RAM to allocate, omit the size specifier and let SmartDrive pick it for you. The default with Windows running varies: 0K for PCs containing less than 1MB of RAM, 256K on systems with 1 to 2MB, 512K on machines holding between 2 and 4MB, 1MB for computers with 4 to 6MB, and 2MB on PCs with over 6MB of RAM.

If possible, devote 1MB or more to the cache. 1MB produces a *hit rate* (the percentage of disk accesses handled from the cache rather than directly from the disk) of about 80 percent. To gauge this yourself, open a DOS window and type SMARTDRV /S. From the resulting report, sum the cache hits and misses, divide that into the cache hits only, and multiply by 100. For example, suppose the display says, "There have been 1,913 cache hits and 587 cache misses." The current hit rate, then, is [1913 / (1913 + 587)] * 100—76.5 percent. If you own the Windows Resource Kit (a $19.95 book and disk package from Microsoft chockfull of Windows information you won't find in the *Windows User Guide*), use the included SmartMon utility to monitor SmartDrive's performance.

Installing SmartDrive (or a similar program) is the single most important change you can make to boost Windows' speed.

Loading SmartDrive high on a PC that uses a bus-mastering ESDI or SCSI hard disk controller may cause data loss if you fail to enable *double buffering* (explained later in this article). When you load an application into a UMB, DOS actually places the code in extended memory but fools the program into thinking it's loaded below the 1MB mark. Bus-mastering controllers bypass the CPU and DOS, though, when copying data from disk to memory. So if a controller isn't smart enough, it will write to upper memory, never realizing that SmartDrive's buffer is physically located elsewhere. To eliminate this possibility, double buffering places the buffer in conventional memory. Fortunately, SmartDrive can tell you whether or not to use double buffering. See Chapter 14 of your Windows manual for details.

USE A PERMANENT SWAP FILE If you run Windows in 386 Enhanced mode, you can boost performance by using a permanent, rather than a temporary, swap file. Either type increases the amount of RAM that Windows perceives is installed on your PC. When memory requirements exceed the amount actually available, Windows stores data in this file. The less RAM you have, the more a swap file helps.

A permanent swap file is a hidden file of a fixed size (which you set) that resides in the root directory of the drive you choose. It occupies contiguous clusters, in order to give it the fastest possible access time. If you have two hard disks, place the swap file on the speediest to get the quickest response.

Before setting up a permanent swap file, it's a good idea to maximize contiguous space by compacting the disk; if your disk is too fragmented, you may not be able to create a file of the size you want. Also, if you defragment a hard disk already containing a permanent swap file, you shouldn't let the file be moved. By default, though, most defragmenters don't disturb hidden files.

Windows 3.0 made selecting a permanent swap file rather painful—3.1 makes it simple. Just pick 386 Enhanced from the Control Panel and press the Virtual Memory button. In the Virtual Memory dialog box, select Change and, under Type, choose Permanent.

You'll discover only one drawback to using a permanent swap file: the space reserved for it is unavailable even if Windows isn't running.

USE FASTDISK, IF POSSIBLE Under Windows 3.1, when you click Change to expand the Control Panel's Virtual Memory dialog box, you may notice a small check box at the bottom labeled "Use 32-Bit Disk Access." When this option (sometimes called FastDisk) is enabled, Enhanced-mode Windows communicates directly with the hard disk controller. In this way, it avoids the disk access routines stored in DOS and the BIOS (which take more time because Windows must switch from protected to real mode to use them). By employing its own 32-bit protected-mode driver to talk with the controller, FastDisk speeds disk access, improving Windows' performance. Figure 1 illustrates FastDisk schematically.

If the 32-bit access box isn't already checked, check it. You'll have to restart Windows to get FastDisk going, but before you do, be sure to *back up your hard disk!* Windows disables FastDisk by default because some controllers *appear* to be FastDisk-compatible when they really aren't. Used with an incompatible controller, FastDisk could destroy the files on the hard disk and render it completely unreadable.

If you don't see the 32-bit access box, Windows setup determined that your controller won't get along with FastDisk, which only works with those based on Western Digital's WD1003 chip and 100 percent compatibles. Microsoft estimates that this covers about 90 percent of the controllers in use today, but that figure is probably shrinking because few ESDI and SCSI hard disk controllers are WD1003-compatible.

If Windows doesn't offer you the option of enabling FastDisk but you know *beyond a shadow of a doubt* that your controller is WD1003-compatible, you can enable FastDisk manually. Add these three lines to the [386Enh] section of SYSTEM.INI:

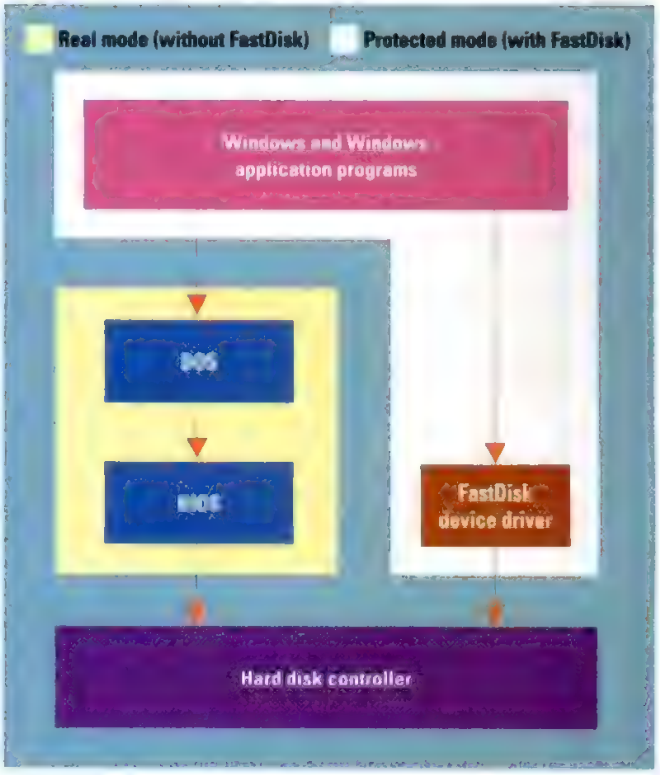
```
32BitDiskAccess=On
device=*int13
device=*wdctrl
```

Once again, before you restart Windows, be sure to *back up your hard disk* just in case the controller is *not* FastDisk-compatible.

Enabling FastDisk delivers another benefit besides speed: If a DOS session is running in the background, Windows no longer needs to keep it all in RAM. As a result, you are able to open more DOS windows, and Windows applications gain back some of the RAM they would otherwise lose to the DOS windows.

DEFRAGMENT YOUR HARD DISK You should defragment the files on your hard disk regularly under any circumstances, but especially if you are running Windows. Windows accesses the disk much more frequently than DOS, and its applications tend to consume more disk space than their DOS counterparts.

How FastDisk Speeds Disk Accesses



Windows 3.1's FastDisk speeds disk accesses by using a 32-bit driver to by pass the DOS and ROM BIOS disk routines. The driver runs in protected mode, whereas DOS and BIOS routines require time-consuming switches to real mode and back.

Many of the popular DOS and Windows utility packages include disk defragmenters. DOS 6.0, slated to be released in the first half of 1993, will probably include one as well.

As a general rule, anything that speeds up your hard disk will also help to speed up Windows.

FIRE THE PRINT MANAGER Slow printing is high on the list of frequently heard Windows complaints. You can bump up the speed by selecting High Priority from the Print Manager's Options menu, but at the expense of reduced performance everywhere else in the system. For most users, bypassing the Print Manager altogether offers a better solution. To do so, open the Printers dialog box from the Control Panel and clear the "Use Print Manager" check box at the bottom of the window.

You will lose some conveniences by doing this. After an application begins printing, it will take longer to return control to you. Also, you'll sacrifice the ability to start a second print job until after the first completes. For sheer speed, though, it's tough to beat.

USE STANDARD MODE It's true: Standard mode is faster than 386 Enhanced mode, especially for DOS applications. You give up other benefits by switching from 386 Enhanced mode, though, such as virtual memory and the ability to run DOS applications in windows. Still, if speed is your thing, then start Windows with the /S switch and give standard mode a try.

TRIM THE FAT FROM WIN.INI WIN.INI tends to grow with time and, if it becomes too large, can significantly impede performance. Windows consults WIN.INI at startup (to obtain values of important system parameters), thus the performance degradation is most noticeable at that point. A large WIN.INI file can also increase the time it takes to begin applications such as Word for Windows.

The problem is exacerbated by the

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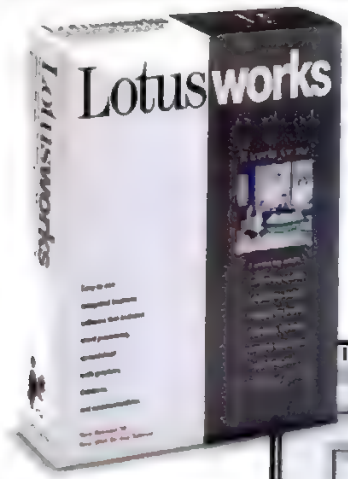

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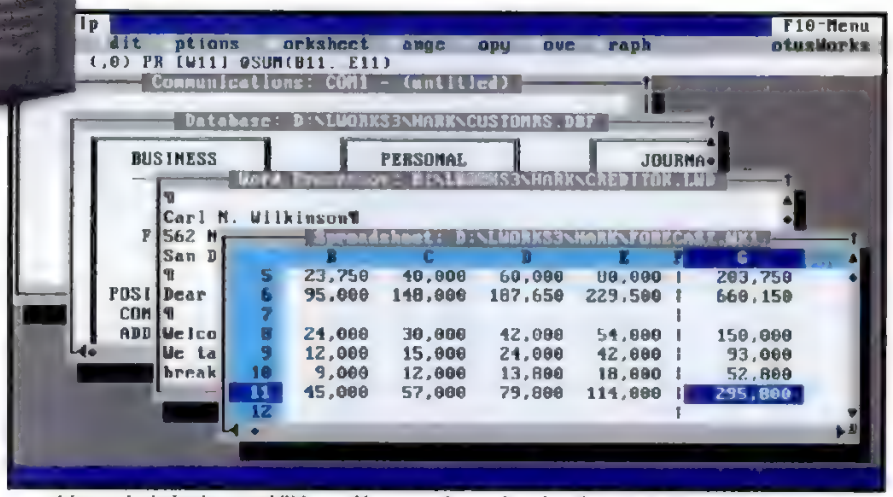

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fact that many Windows programs add statements to WIN.INI on installation but don't remove them if uninstalled. To guard against uncontrolled growth, you should occasionally delete unused entries. Unfortunately it's often difficult to tell which statements are no longer used.

You can get around the problem by copying WIN.INI before installing a new program or running it for the first time. Afterward, compare the current and previous WIN.INI versions, noting the changes. Keep a list of modifications that each program makes; then if you must remove an application, the list shows you which entries to delete.

For an even better way to track WIN.INI changes, use Neil Rubenking's INCTRL utility, presented in the July 1992 Utilities column. You can download it from Library 2 (PCMAG UTILS) of the Utilities/Tips forum on PC MagNet.

Fortunately, more and more Windows programs are making use of private INI files, which provide a convenient vehicle for storing settings on-disk without cluttering WIN.INI.

FINE-TUNE SYSTEM.INI A number of settings in SYSTEM.INI's [386Enh] section affect performance. FileSysChange=On, for example, tells Windows to notify File Manager any time a non-Windows application creates, deletes, or renames a file—which can decrease performance noticeably.

The statement VirtualHDIrq=Off slows drive performance by forcing Windows to rely on a ROM BIOS routine to handle interrupts from the drive controller. Some PCs require the VirtualHDIre=Off setting, but if it's Off on yours, try changing it to On. Windows may refuse to start in 386 Enhanced mode or may lock up after starting. If so, simply edit the VirtualHDIrq statement and restart Windows.

If DOS windows seem sluggish in 386 Enhanced mode, try adding WindowUpdateTime=10. This statement specifies the period in milliseconds between DOS screen updates. The lower the value, the more frequently the window is updated (the default is 50). This actually *decreases* overall performance, because Windows pauses more often to freshen the screen. The application in the DOS window will *appear* to run more quickly, though.

If you routinely run one or more DOS sessions in the background while Windows applications execute in the foreground, you might benefit from setting WinExclusive to Off, which suspends DOS programs in the background. As an alternative to directly editing the entry in SYSTEM.INI, check the "Exclusive in Foreground" box in the Control Panel's 386 Enhanced window which does the same thing.

CONSIDER HARDWARE UPGRADES Don't overlook the importance of hardware when you're searching for ways to limber up Windows. CPU and hard disk upgrades are expensive but others are rather cheap. The more RAM you devote to Windows, for example, the faster it runs; more memory means fewer disk accesses as Windows juggles programs. At the current price of roughly $75 per megabyte, you can upgrade a 2MB PC to 4MB for less than the cost of an average application. You may be surprised by the difference it makes in speed.

Don't overlook the importance of hardware when you're searching for ways to limber up Windows.

Make sure that the new RAM goes in as extended, not expanded, memory. Windows 3.1 has little use for expanded memory other than to satisfy the needs of EMS-aware DOS applications running in standard mode. In 386 Enhanced mode, Windows converts extended memory to expanded memory on demand for DOS applications.

A Windows video accelerator such as the ATI 8514/Ultra—which sells for as little as $399 with 1MB of fast VRAM—supercharges Windows another way (for a review of 13 popular accelerator boards, see "Graphics Accelerators: Pump Up the Power" in the March 17, 1992, issue of *PC Magazine*). These devices offload common video operations such as line draws, area fills, and BitBlts (a block pixel move that is executed when you move a window or scroll the screen, for example) to a specialized graphics coprocessor, while allowing other, less common operations to be handled by the CPU. A dramatic increase in performance results, often two to four times that of a standard video adapter.

Graphics-mode screen operation introduces high overhead and taxes the data bus when large blocks of pixels are moved or modified. Video accelerators get right to the heart of the matter, eliminating (or at least improving upon) the video bottleneck.

Most accelerator boards also offer higher resolutions than standard video adapters, but this is a mixed blessing. The higher the screen resolution and the greater the number of colors supported, the slower Windows will run. In general, limit the resolution and colors to what you need to get the job done. Windows will thank you for it.

LOOK FOR FASTER DRIVERS Factors other than hardware can limit Windows' speed. The device drivers it uses to communicate with hardware such as video boards and printers play an important role, too. If poorly written, they can slow Windows to a crawl.

Make sure you use up-to-date drivers. Hardware vendors constantly improve them to speed Windows performance, and updates are often available free of charge. In some cases, third parties publish faster drivers. Panacea, for example, claims its WinSpeed—a collection of Windows video drivers for popular Super VGA boards—increases display speed by two to five times. The program works with any Super VGA based on the Tseng ET4000 chip as well as boards from ATI, Paradise, and Trident. To find out if Panacea supports your video card, call the company at 800-729-7420.

OTHER CONSIDERATIONS These aren't all the configuration changes you can make to Windows to improve speed, but they're among the most important. You can also run DOS applications full-screen rather than windowed in 386 Enhanced mode and put the Windows directory first in your PATH statement. It's also a good idea to run CHKDSK periodically (make sure that you run it from outside of Windows, not from a DOS prompt within it) in case your hard disk contains any lost allocation units or cross-linked files. □

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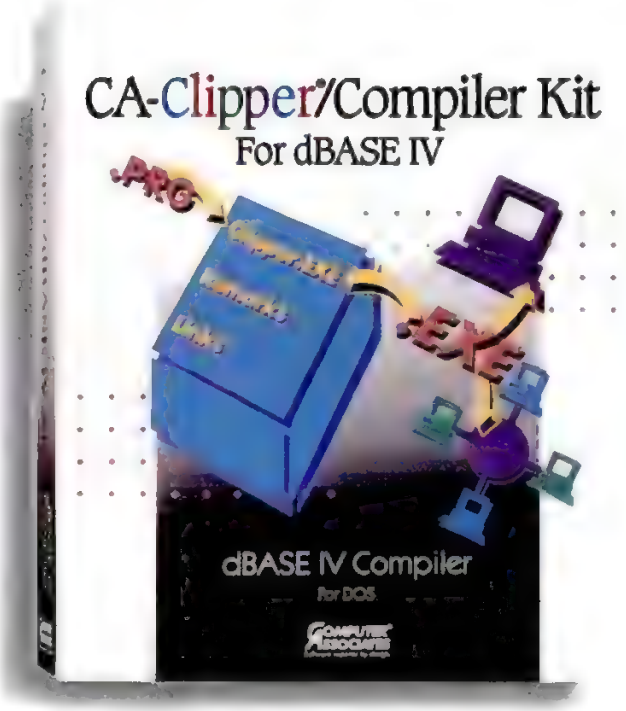

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A Look Inside PC Magazine Labs' New Benchmarks

BY NICK STAM AND ROBERT W. KANE

The products in this issue's "Upgradable PCs" review are the first to be tested with Release 7.0 of PC Magazine Labs' Hardware Benchmark Tests, and with Winbench, Release 3.1, both of which are now included in PC Magazine Labs' Benchmark Test Series. Release 7.0 adds many enhancements to our tests of a PC's disk, CPU, memory, and video subsystems. The latest revision of our Windows Benchmark Tests (Winbench) now contains a Disk Winmark as well as a revised Graphics Winmark. (The Winmark is a combined score from the component-level measures made from within Winbench.)

Upgrading benchmark tests is never easy or quick, even for the combined forces of PC Magazine Labs and of our parent company's Ziff-Davis Labs. In this article we'll outline the changes we've made, talk about the benchmark architecture, discuss the sophisticated new application profiling techniques used to develop our test routines, and show you how best to benefit from using the benchmark tests when evaluating systems and peripherals.

CHANGES TO HARDWARE TESTS Advances in nearly every aspect of the PC's system architecture over the past few years have brought radical improvements in overall system performance. The most striking advances, of course, have been in processors. Improvements in the 486, for example, include a built-in 8K cache, burst-mode memory interface, single clock cycle instruction execution ability, improved pipelining, and a built-in math coprocessor.

Altogether, the 486 DX2/66 represents the highest level of Intel-based processing power ever achieved. Measured by PC Magazine Labs' new 16-bit protected-mode instruction mix test, this CPU produces more than 15 times the processing throughput of the 386SX/20 chip. And PC Labs' new CPU-memory instruction mix test shows that, when coupled to external memory to form an integrated system, the DX2/66 delivers up to 12 times the processing throughput of the 386SX/20.

As these figures suggest, our new processor tests were designed to let us distinguish between the raw processing throughput of the CPU itself and the processing throughput of the CPU when it is working within a system. This means you'll be able to see just how efficiently a system manufacturer has interfaced the CPU to the memory subsystem. In addition, you'll be able to measure the performance impact of the presence or absence of an external cache subsystem. That makes it easy to determine and compare the best-case CPU performance levels of various tested systems.

New application-profiling techniques and testing in both real and protected modes give you more useful information when you compare systems and their components.

The distinction between raw CPU processing power and that of the CPU-to-memory interface is most apparent in 486 (and above) designs that use internal caches. When executing typical applications, most 486 systems yield an internal cache *hit rate* that averages from around 85 to 95 percent. (The hit rate is a measure of how frequently the processor finds and fetches instructions and data from its internal cache.) High cache hit rates can contribute to exceptional system performance.

On the other hand, when an application executes large amounts of code, it often happens that all of the code will not fit inside the internal cache. In such a case an instruction read or a data read or write must be serviced by the external memory system. Whether this introduces a relatively slight performance penalty or a considerable one depends on the external memory system design.

A second fundamental change in our Hardware Benchmark Tests involved replacing our older instruction mixes with two new classes of instruction mixes that have been modeled on actual application instruction streams. An instruction mix is the typical combination of instructions that a processor executes when running an application. Our new instruction mixes correlate closely with the instruction streams generated by the DOS and Windows applications that are shipping today. We also took into account the fact that protected mode environments are on a rapid rise and added protected-mode instruction mixes to our processor tests.

Advances in disk controller and drive technology also stimulated revisions in our disk tests. Today's disk adapters may contain anywhere from 64K to 16MB of RAM cache, and many disk drives themselves come with built-in cache subsystems instead of simple track buffers. Our previous disk tests imposed a size limitation of 4MB on the files they could read or write to disk. Disk adapter caches larger than 4MB could thus respond to most of the read requests without ever actually accessing the disk drive. This made disk systems with these large caches seem faster on the benchmark test

than they would perform in real application scenarios.

The same test size limitation of our older disk tests applied to write requests on those disk systems that support write-back caching. Write-back caches intercept disk writes and accumulate them in RAM until a later time, when they are all eventually written to disk. The writing to disk is usually triggered when a predefined percentage of the cache is holding data that is ready to be written. The apparent performance improvement of a write-back cache is very noticeable, since writing to RAM is hundreds of times faster than writing to disk. (You should note, however, that write-through caches are often preferred in situations where data integrity is absolutely critical, such as in transaction processing applications. This is because if a power failure occurs while disk writes are buffered in a write-back cache's RAM, every bit of the data is lost.)

Our new tests will help you determine how effectively your disk processes data files of varying sizes. Assuming your disk subsystem has a 4MB cache, our tests can measure both the time it takes to access data in a cache and the decrease in performance (throughput reduction, seen in fewer kilobytes per second) that the system suffers when the same data is accessed from the disk. We now support up to 32MB file sizes, which, when accessed randomly, can force cache misses in most if not all hardware disk caches available today.

Apart from caching considerations, the new disk tests let you evaluate disk performance across a larger range of disk operations. You may, for example, have data sets much larger than the 4MB disk region tested by our older benchmarks. The random and sequential access techniques in the new benchmark test will better simulate large database accesses. Our new tests also reflect the speed you can expect both when loading a multimegabyte TIFF file and when reading and writing the small files typically used with word processors or e-mail systems.

As in previous versions, we have profiled the disk access patterns found in complex usage scenarios, such as multiuser, multitasking, and networking systems. The increasing market presence of disk array technologies with intelligent controllers and drivers (and of fast SCSI-II drives with high-speed adapters) show that such disk technology will continue to be a critical component in the performance equation.

Because external processor cache and main memory subsystems are often engineered to balance sensitive price/performance models, a good benchmark test suite should be able to detect these design trade-offs. There are two main types of processor caches today: Level-1 (L1) and Level-2 (L2). L1 cache memory usually refers to a cache that is an integral part of the CPU; an Intel 486 microprocessor, for example, contains 8K of L1 cache. Similarly, a Cyrix 486SLC microprocessor contains 1K of L1 cache. L2 cache memory refers to the memory that is external to the microprocessor. Caches such as these typically range in size from 16K to 512K.

In comparison with our previous test, the memory test in Release 7.0 better exercises the DRAM (Dynamic RAM) subsystem by intentionally reducing primary (L1) and second-level (L2) caching effects. Our older memory test did not attempt to discriminate between cache reads/writes and DRAM reads/writes. Our new CPU-to-memory interface test, by contrast, checks the L2 cache effectiveness on 486 systems. As we'll describe later, you'll now be able to compare memory subsystems and isolate the weak points among competing systems.

Truth to tell, the user interface for Release 6.0 *was* a bit sluggish at times. So, with Release 7.0 comes a new and improved UI that provides snappier response, easier navigation, simpler result reporting, test automation, and command-line operations that permit batch file execution of benchmark test components.

From the main screen you can now simply select a processor icon to execute all processor tests. If you choose a Select All option, then all component tests including processor, video, memory, and disk section will be performed. Results can be stored in .DBF or ASCII format and as in the previous version, .DBF results can be used to compare test results of multiple system configurations.

WINBENCH UPDATES Winbench, Release 3.1, contains significant test upgrades as well. As Windows applications are revised (a continuous process!), we profile them to learn just *how* they use Windows. Of special concern is how they interact with the GDI, USER, and KERNEL components of Windows.

We also profile Windows applications to determine the exact distribution, frequency, and typical parameter values of Windows GDI calls. In the past we could profile only GDI call frequency. Now, with more sophisticated profiling tools at our disposal, we are also able to capture the dimensions of operations used by such calls as BitBlts, line draws, and polygon fills. The new Graphics Winmark will thus allow you to better select video subsystems for use with Windows.

Previous Winbench tests only measured the performance of graphics operations used frequently by Windows applications. However, disk operations and memory management functions are also important Windows performance criteria. Even though there are no specific Windows disk API calls, the SmartDrive cache that comes with Windows intercepts disk calls made by applications. It works intelligently with Windows by allowing system memory to be dynamically shared between the SmartDrive cache and the Windows kernel code that performs memory management. Other third-party disk cache systems for Windows, such as PC-KWIK's Winmaster, affect Windows application performance as well. Therefore we felt that it was important to develop tests that would measure the effects of disk caching under Windows.

The Disk Winmark homes in on disk performance by putting the emphasis on exercising caching effects and hardware efficiencies. With SmartDrive's write-back algorithm, we can now provide test options that allow you to measure apparent and actual disk performance, as explained below.

THE ARCHITECTURE Release 7.0 of the Hardware Benchmark Tests, was designed to run on any 80286 or later PC using DOS 3.1 or later (although DOS 5.0 is recommended). With Release 7.0 we have abandoned 8088 support, as our reader polls and system vendor interactions indicate no further interest in performance measurements of those early systems.

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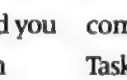

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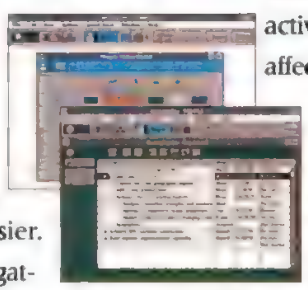

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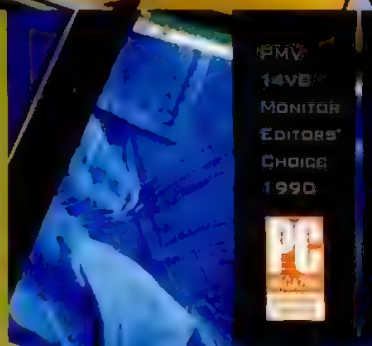

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following tools: Borland C++, Version 3.1; Borland Turbo Assembler, Version 2.5; Sequiter Software's Codebase++, Version 1.4; Zinc Software's Zinc Interface Library for DOS, Version 2.0; and Phar Lap's 286 DOS Extender. The Phar Lap code was used specifically for getting in and out of protected mode with our new protected mode instruction mixes.

You can run the new benchmark tests either interactively (from the command line) or via a batch method. The latter method can be invoked from within the BENCH7 program or from a DOS prompt. Batch execution allows you to specify which tests you want to run automatically, without manual intervention.

The batch file editor included in BENCH7 lets you create a variety of special purpose batch files that can be used to run all or portions of the benchmark tests. By using the batch editor you also ensure that individual test information is saved to a data file that can be read by our batch execution code.

From the DOS command prompt, the name of the batch data file is passed as a command line parameter. For example, a batch command line might look like this:

```
bench7 /b /fdata.fil
```

Here, /b indicates batch mode processing, /f is the filename switch, and *data.fil* is the filename to be read by the batch function. Note that no spaces are permitted between /f and the filename.

Generally, you should load and run the benchmark tests on a clean machine; that is, one without device drivers, interface shells, or anything else that takes up unnecessary conventional and extended memory. Otherwise, performance results may be affected. When comparing different systems you should also be sure that their CONFIG.SYS and AUTOEXEC .BAT files are set up similarly.

Note that some portions of the new benchmarks , such as the extended memory test, will not run if they detect VCPI or DPMI extended memory management services such as are found in 386-MAX.SYS, EMM386.SYS, and QEMM .SYS. We're looking at incorporating VCPI and DPMI compatibility in future benchmark releases.

Possibly the single most important advance in the design of our new benchmarks lies in the fact that many of the component tests have been modeled closely on application software and operating system usage of the various PC subsystems. This is a critical aspect of component-level benchmark design: Without understanding how applications affect underlying hardware, component tests lose much of their effectiveness.

For component subsystems that are subject to a large number of possible usage scenarios we not only chose to test using common application operations, but we also applied weighting factors *in proportion to the operation's occurance.* For example, for the new disk tests we measure 72 different sequential and random operations across different file and data block sizes and weight each operation separately.

In our new benchmark tests, many component tests have been modeled closely on application software and operating system usage of the various PC subsystems.

PROCESSOR TESTS We have revamped major portions of our processor tests in Release 7.0. In the past we used separate 8088, 80286, 80386, and 80486 instruction mixes together with assorted other processor-dependent tests. After consulting with major chip vendors we decided that our processor instruction mixes should be written to test real and protected modes rather than which CPU was being used.

We also decided that we should focus on 16-bit and 32-bit instruction mixes. Looking back—even to versions earlier than 6.0—the only difference between the 80386 and 80486 mixes consisted of a mere six instructions unique to the 486. That's hardly enough to distinguish the two tests when hundreds of other identical instructions were in both mixes.

Another reason for rewriting the processor tests was that the older mixes ran only in real mode. Any references we had made to 32-bit addresses or registers from real mode required operand and/or address override bytes in those instructions. Few applications today run 32-bit operations from real mode; in fact, few common applications run 32-bit code in any mode!

We worked with all the major chip vendors to profile many DOS, Windows, and OS/2 16-bit applications to analyze just how they use the processor. We were able to get frequency and duration counts of all instructions executed by those applications. Based on this data, we were able to engineer two instruction mixes that are essentially synthetic applications that closely represent real applications as far as the processor is concerned. We created two such mixes: a small mix, approximately 1K in size; and a medium mix of approximately 48K. You can run both mixes either in real or protected mode by making selections from Release 7.0's processor test menus.

The reason for the 1K small mix is that it will fit inside the built-in cache of most 486 and compatible systems. It thus provides a "best-case" measure of processor performance. Running a mix entirely inside the processor cache is not the best overall processor performance measure, however, for the bus interface unit and cache line-fill logic are not heavily exercised. So we also created the medium-size mix, which stresses the interface between the CPU and memory subsystem. (You can expect an additional mix that will be much larger in our next release.)

We picked 48K for the approximate size of the medium mix so that the code and data segments will fit inside the second-level (L2) caches of most 486 (and above) systems. On 286 and 386 systems, both the small and medium mixes will force memory accesses outside the chip at all times. The medium-size mix is built around portions of the 1K mix, with only the few minor changes needed to tie many iterations together. Essentially, we have created multiple 1K, 2K, and 4K segments inside the medium mix while maintaining the proper opcode distributions.

A large portion of the medium-size mix will be serviced from the internal 486 cache, just as that cache will service typi-

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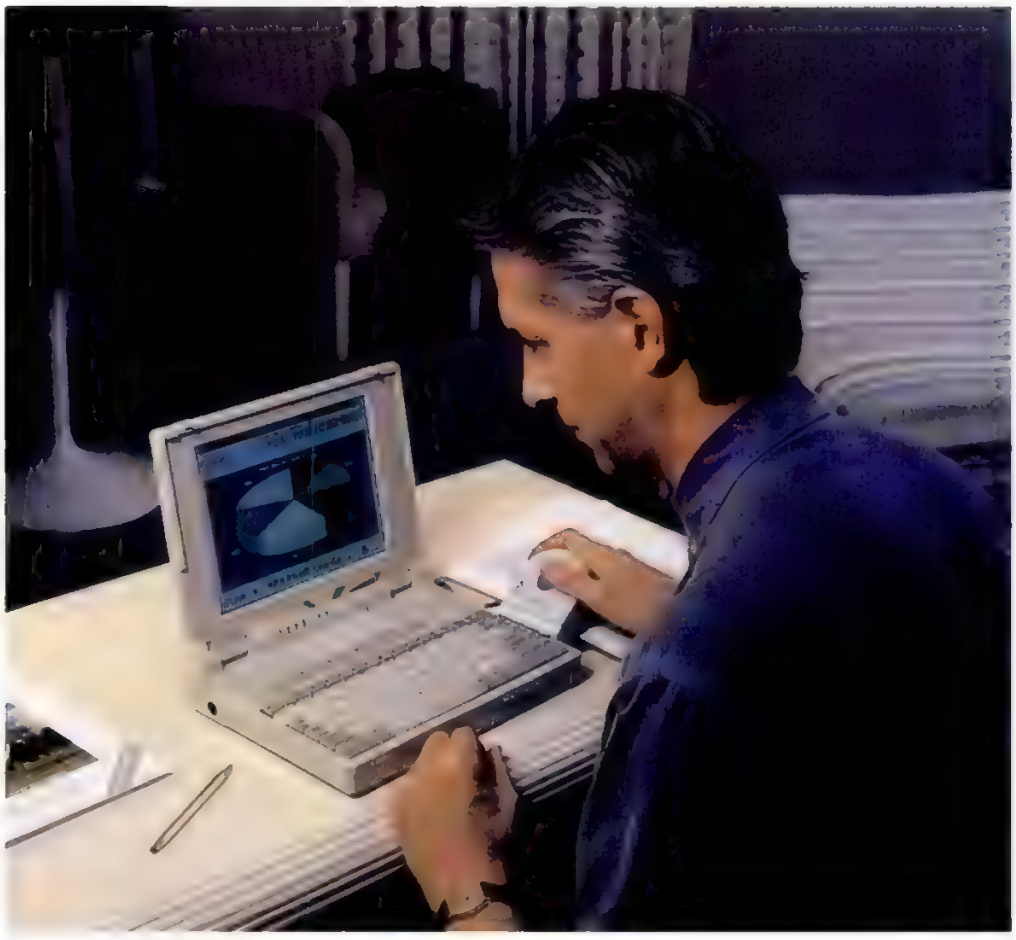

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cal applications. Although the mix is much larger than the 8K internal cache of an Intel 486, the looping structure of the instruction mix ensures that some portion of the code will be executed from within the cache and some code will be executed from outside the cache.

The loops in our instruction mixes are also engineered to represent code runs similar to those found in typical applications. If you're an assembler programmer, you'll be interested to know that we have not only counted JMP instructions, but we have learned on the average how many are taken and how many are not. Moreover, we have determined how many other instructions, on the average, are executed before a JMP occurs. By factoring all these considerations into the mixes we believe that we have created a sophisticated and accurate component-level processor benchmark test for the Intel-class PCs.

Using the new instruction mixes, the test reports the number of complete instruction runs (or passes through the entire mix) that are executed each second. Naturally, the small mix will show a much higher number of completed runs than the medium mix because of its smaller code size. You'll also observe that the real-mode mixes are always faster than the protected-mode mixes. That's because there is more overhead involved in loading segment registers in protected mode. Most instructions that work with segment registers simply take longer to execute in protected mode.

Because general-purpose 32-bit applications are still lacking under OS/2 2.0 and Windows NT is still in beta, we have chosen not to implement 32-bit instruction mixes in Release 7.0. To create proper 32-bit instruction mixes we need to have a broad base of 32-bit applications we can profile to determine how they use the processor. By Fall Comdex in 1993, you can expect our 32-bit mixes to be released.

For most of the applications and operating systems on the market today, our 16-bit mixes are quite representative. As an aside, however, you should know that our new memory tests do stress-test the 32-bit local bus of a 386 or 486 PC. In fact, the memory tests also stress-test the processor and cache subsystems.

We decided that the string sort and move, sieve, floating-point emulation, and coprocessor floating-point tests should be kept in the processor test group, but that we should give weight only to the instruction mixes and floating-point tests. The floating-point tests are in fact given little weight in comparison with the instruction mixes because so few programs actually use floating-point instructions.

We removed the 128K NOP and the DO-NOTHING LOOP from our new processor tests because they make use of the NOP instruction. We have learned that some of today's chip vendors are tuning the NOP instruction for compatibility purposes. Cyrix Corp., for example, sets the NOP to run at three clock cycles when it could have easily been set to run at one clock. The company claims that some older software used the NOP to perform timing loops. In the light of that contention we decided to eliminate any test based on the NOP instruction.

MEMORY TESTS For Release 7.0 we also rewrote the memory tests, which are designed to exercise a system's raw memory speed. These tests include: extended memory tests, conventional memory tests, graphics memory tests, text video memory tests, and BIOS memory tests. Because we factor in only the results of the extended and conventional memory tests when rating machines comparatively for publication, we'll limit detailed discussion to these tests. The remaining tests can be used to inspect the speed of the other memory regions. The BIOS memory tests will immediately tell you whether the BIOS is or isn't shadowed in RAM because, if not shadowed, the BIOS read performance tends to be much slower than standard DRAM reads. Although the graphics memory and text video memory tests differ from those in our video suite, they do provide a raw speed test of the memory residing at A0000 (for the graphics test or the text video test).

The extended memory test operates in protected mode. Before executing the actual test, an initialization routine determines the amount of available extended memory, whether VCPI or DPMI extended-memory services are present, and the start and end addresses of the region to be used for testing. Note that in Release 7.0 the extended memory test is incompatible with all extended memory services except the XMS and the INT 15 methods. You'll be notified that the test cannot run if one of the other services is present.

The test reads and writes 8-bit, 16-bit, and 32-bit quantities into every memory location sequentially, from the start address to the end address. All results are reported as throughput figures in kilobytes per second. For presentation in *PC Magazine*, we average the results of all the extended and conventional tests to arrive at a single memory performance number. Each of the test components is weighted according to the frequency of its execution, as determined by our application profiles. We give more weight to protected-mode operations than to real mode. The editorial decision to weight protected mode more highly is based on current industry trends and increasing sales volume of protected-mode environments and applications.

The conventional memory tests also determine the amount of memory available to the test program and then proceed to read and write 8-bit and 16-bit quantities in real mode. Although performing 32-bit operations in real mode is possible, not many applications do it. Moreover, we would have to add the overhead of address and operand override bytes to switch the processor into a 32-bit mode of operation.

Because we are reading sequentially through a large memory space, it might seem that we are not really touching any L1 or L2 cache subsystems that could be present, as in a 486 design. While it is true that we are not looping as programs normally would (so causing many repeated cache hits), the caches *are* being exercised, though in a different manner.

To see how this works, assume that a 486 system under test has both an L1 and L2 cache and that both caches contain no data from the targeted memory locations. Assume also that both caches have 16-byte (8-word or 4-double-word) line sizes. Now, let's analyze the extended memory test as it performs a 16-bit read.

When the test program asks for a 16-bit word, the controlling logic in the internal L1 cache realizes it doesn't have the data. It must therefore invalidate the entire cache line (the smallest memory area the cache can handle) and perform a

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cache line-fill operation. The request for the line-fill is sent to the external memory subsystem, which may or may not have an L2 cache. In this example we'll assume that there is an L2 cache and that the L2 cache controller will field the processor's line-fill request. The L2 cache now determines that it does not have the required data either, so it has to ask for a line-fill from the DRAM controller.

There are two standard methods of external (L2) cache design, look-through and look-aside (not to be confused with write-through and write-back), so we must discuss the operations of each. When the processor puts a line-fill request out to a look-aside design, the request goes both to the L2 cache controller and to the DRAM controller. If the L2 cache controller determines that it can satisfy the request without having to perform a line-fill of its own, it does. Otherwise it yields to the DRAM controller, whose access is already in progress. In a look-through cache, by contrast, the DRAM controller would not get the wake-up call until the L2 cache had determined that it didn't have the requested data. Thus, a look-aside design is more advantageous.

Whether it comes from the DRAM controller or from the L2 cache controller, when a line-fill occurs in the L1 cache, the L1 cache will contain the next 16-bit word requested by the test program. It will also contain the next 6 words requested, since the L1 cache in a 486 contains 8 words per line. In a look-through cache design, if the L2 cache has to fill its own line before filling the L1 line, the presence of the L2 cache can actually slow down the read operation. (This is called a double miss.) Our 8-, 16-, and 32-bit read tests compare each of the memory subsystems by forcing cache line misses and seeing how quickly the system can retrieve data. This puts extra stress on the DRAM system and rewards rapidity in cache line-fills.

The presence of a write-back L2 cache speeds things noticeably in our write tests. This is because while the CPU is writing data out, the L2 cache can be buffering the data and writing it out, asynchronous to the decoding and execution of the write instructions by the processor. (A 486 internal cache is a write-through cache.)

You can experiment with different 486 designs by disabling the L1 and L2 caches (supported on many systems in their setup utilities) to see just how fast the DRAM system is. Similarly, you can enable L1 but keep L2 disabled (or vice versa) to obtain different measures. You'll see that, despite the fact that we are reading sequentially in the read tests, the internal and external caches have a definite impact. This goes double for write-back versus write-through caches. Some cache controllers allow you to turn write-back on and off; if so, you'll see drastic differences in the results. For 286 systems, this memory test really exercises the main system memory; the same is true for those 386 systems that lack a cache.

VIDEO TESTS The video tests in Release 7.0 are identical to those of Release 6.0. These consist of 8- and 16-bit direct text screen writes and a number of graphics operations performed directly on graphics memory. The BIOS scrolling tests are given no weight, however, since for usability reasons many system BIOS vendors actually tune their scrolling to be either fast or slow. Vendors may tune the BIOS slow because systems today are so fast that data often scrolls off the screen faster than you can read it. Vendors may tune the BIOS fast simply to look good on benchmark tests. Therefore, as with the NOP tests, we feel our BIOS tests are no longer true performance measures. Moreover, most software avoids using the BIOS routines for video output.

DISK TESTS As mentioned earlier, in response to the rise of caching controllers and built-in drive caches, we have enhanced our disk tests to handle larger working areas on-disk. Our previous tests were limited to 3.84MB of data, which meant that any 4MB caching controller (standard gear on some of today's high-end PC's) could hold our entire data set in memory. While this could arguably be considered a price/performance issue, we felt it necessary from a testing perspective to be able to retrieve data both from the cache and from the disk.

We have therefore developed a test that attempts to allocate a 32MB file space and that runs a variety of sequential and random disk accesses within that space. If we can successfully allocate a 32MB working area, we create a full 32MB file. We then perform sequential and random reads and writes of 200 bytes, 512 bytes, 2K, and 4K block sizes within that file.

For example, a sequential read test using 4K block sizes would start by positioning the file pointer to the beginning of the file and reading 4K blocks sequentially for 20 seconds. If the end of the file is reached within that time, we seek back to the beginning and start over until 20 seconds have elapsed. The throughput, in kilobytes per second, is then calculated. The sequential write tests are similar.

The random reads and writes are just that: random. These tests produce significantly lower throughput numbers because the disk head has to move around much more. Read-ahead logic produces no measurable performance improvements in our random tests.

Having performed these operations on the 32MB file, we truncate it to 16MB and repeat the same set of tests. We continue down to 8MB, 4MB, 2MB, 1MB, and 256K file sizes. The lowest file sizes will definitely fit inside of most controller caches. We assign weight to the random results for all file sizes, but only the 1MB and 16MB file size sequential test values are factored in. Reads are weighted more heavily than writes, per application profiling. In all, the new disk tests should give you a good indication of the maximum speed of your disk subsystem.

DIVING INTO WINDOWS The goals of our new Winbench 3.1 revision were twofold: to update the Graphics Winmark to test the most frequently occurring graphics operations we found used in this year's popular Windows applications, and to create a new Disk Winmark.

The Graphics Winmark focuses specifically on analyzing GDI calls and so provides a yardstick for determining the performance of a graphics subsystem for use with Windows. As you're no doubt aware, many new graphics accelerator cards and local-bus technologies have been released in the past year. Our updated test determines how effectively those technologies operate in a Windows environment and process Windows GDI calls.

The Graphics Winmark comprises 12 popular Windows GDI calls as determined by application profiles. These include: system font display, New Times Roman font display, memory-to-screen

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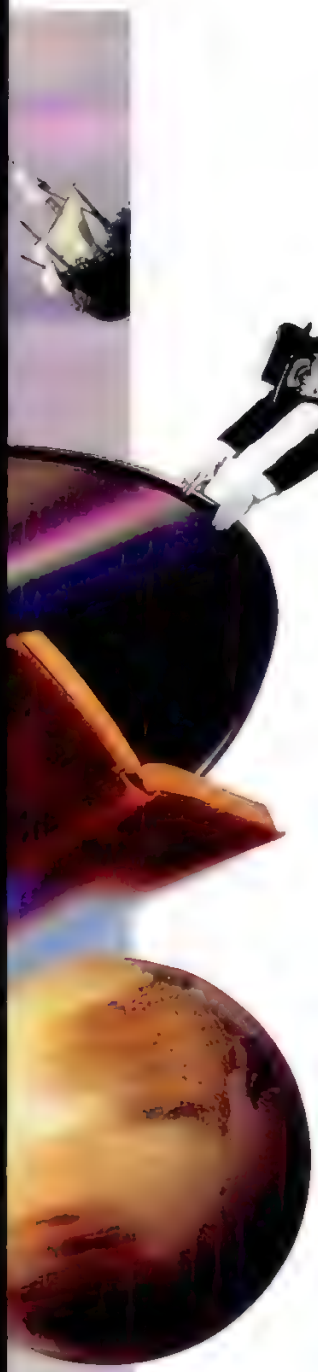

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pattern invert, memory-to-screen pattern copy, memory-to-screen source copies, alternate polygon fills, single horizontal lines, single vertical lines, single diagonal lines, horizontal polylines, vertical polylines, and diagonal polylines.

Because our Winbench tests are designed to reflect actual application use, you will notice when you run the Graphics Winmark test that we have applied weighting factors to the individual graphics and text operations. These weights correlate directly to data obtained from our application profiles. We use a weighted harmonic mean equation to derive the Winmark number as explained below.

In amassing our API information we profiled Windows applications such as Aldus PageMaker, CorelDRAW, Harvard Graphics, Lotus 1-2-3, Microsoft Excel, Microsoft Word, Superbase 4, Windows applets, WordPerfect, and a number of other applications. To profile these applications we had to first develop detailed application-execution scripts. The scripts were designed to emulate the functions typical users execute within each application. We directly interviewed many users of each application in person and by telephone, and we also solicited input using surveys placed on electronic bulletin boards. The application scripts were developed by *PC Magazine*, and Microsoft's MS-TEST tool was used to automate each Windows application.

In addition to working on our own internal Winbench test procedure, Ziff-Davis has entered into a joint development agreement with Microsoft to develop a benchmark test called Winstones. Winstones is intended to measure overall Windows performance on a system. The development agreement was announced in March of this year at the Microsoft Hardware Engineering Conference in San Francisco. *PC Magazine*'s responsibility is to poll users and develop realistic application scripts that will track what users actually do with their applications. Microsoft's job is to then develop the Winstone benchmark test itself.

The application scripts we devised have already served the dual purpose of fostering both Winstones and Winbench development. Our new Winbench tests execute fairly rapidly, and the resultant data can be stored to a file.

Two special design considerations are built into the Disk Winmark: It works with an 8MB file, and it attempts to exercise SmartDrive caching effects. At PC Magazine Labs we request that all systems to be tested be delivered with 8MB, if possible. We also set up a 2MB SmartDrive cache for the Winbench test.

Because the new SmartDrive 4.0 has write-back capability, we have included a provision that allows you to measure both apparent and actual disk performance with SmartDrive's write-back setting enabled. To insure that any deferred writes do not interfere with the reads, the test flushes the data from the cache, forcing the disk to complete all pending write operations.

The "apparent" test setting measures the speed of the writes as they appear to the user. Since our program regains control quickly when SmartDrive write-back caching is enabled, you're likely to think that the write event is finished when it is really scheduled to occur later, in the background. We flush the cache even after reporting the "apparent" result in order to prevent possible interference with the next test.

Users have always desired a single overall DOS system performance number, and we have devised a scoring method based on application profiling to combine the disk, video, CPU, and memory test results into a single overall performance factor. We are naming this result the DOSmark. It is strongly influenced by disk and CPU speed, and less so by video and memory speed. We have measured the speed of multiple functions in a large number of DOS applications and correlated test results to the results obtained with our individual component tests (disk, video, CPU, and memory). Using weighted harmonic mean equations, we were able to derive a DOSmark rating that correlated better than 99 percent with DOS application performance. You will see the DOSmark in this issue's "Upgradable PCs"review, and it will be used in all system reviews in the future.

WHAT DOES IT ALL MEAN? That actually depends on which mean you use! After studying this question, we have decided that the harmonic mean represents the best averaging method for benchmark tests whose results are given as rates, such as kilobytes per second or passes per second. Assuming the total time required to run a given set of tests is the ultimate measure of computer performance, the harmonic mean is the best measure because it basically measures the total number of benchmark test operations divided by the total amount of time required to run the tests.

We use a weighted harmonic mean within all test groups, such as processor, video, disk, memory, and Winmark. The weighted harmonic mean is used to allow us to alter the importance of one individual benchmark test component versus another. For example, we've found that certain bit-block transfer (BitBlt) graphics operations occur frequently in Windows applications, so we assign a higher level of importance, or weighting, to those operations.

We have compared aggregate performance results using harmonic, geometric, and arithmetic means and have determined that the harmonic mean correlates most closely with the overall time that a user would spend executing a particular set of operations on a system under test.

In Release 6.0, our reason for using a geometric mean was to give each test component equal status. We were thus not concerned with the overall time required to execute the entire suite. While this yielded results that differentiate systems fairly in virtually all cases, by shifting our emphasis to the total time a user has to spend we are following the generally accepted industry practice of aggregating benchmark test measurements.

We hope that you find our new benchmark tests useful. If you would like the tests for your own use, you can download them from PC MagNet. Downloading instructions are in the sidebar "Utilities by Modem" in the Utilities column in this issue. If you don't have a modem, you can request the benchmarks by sending a postcard with your name, address, and preferred disk size to: Benchmarks, PC Magazine Labs, 4th Floor, One Park Avenue, New York, NY 10016. Or you can fax your request to 212-503-5518. □

NICK STAM IS THE HARDWARE TECHNICAL DIRECTOR OF PC MAGAZINE LABS. ROBERT W. KANE IS SENIOR TEST MANAGER OF ZD LABS.

Mailing Lists Are a Snap to Print with MLPRINT

BY JAY MUNRO

Do you still have to tweak the margins to print out your mailing list on address labels or envelopes? Would you like to add postal bar codes to speed up delivery—and possibly save money, too? In either case you'll want to check out this issue's free utility, MLPRINT.COM.

MLPRINT is designed to implement three standards: HP LaserJet labels and envelopes, the Postnet (Postal Numeric Encoding Technique) bar codes, and the U.S. Postal Service (USPS) approved address format.

HP LaserJet–compatible printer escape codes are built into MLPRINT. Quick setup screens let you select among ten label and five envelope sizes. Envelopes can include a return address of up to 6 lines of 40 characters, and you can set up either for LaserJets that center-feed or for those that right-feed envelopes. The regular paper tray or manual feed can be used alternatively for label sheets or envelopes.

For either labels or envelopes MLPRINT will create the optional Postnet bar codes from 5-digit (normal), 9-digit (ZIP+4), or 11-digit (ZIP+4 plus delivery-point information) ZIP codes. The output from MLPRINT can be fed directly to the printer or redirected to a specifiable filename for later printing.

Details about the standard address format will be discussed below. For further information on how the Postnet bar code is encoded, see the sidebar "The Postnet Bar Code." The sidebar "Using a CASS-Certified Address List" explains the postal requirements for obtaining discounts when you use preapproved address lists.

You can download a copy of MLPRINT.COM and its assembly-language source code from the Utilities/Tips forum on PC MagNet, archived as MLPRIN.ZIP. See the "Utilities by Modem" sidebar for instructions. If you modify the code (to include a different label format or to change the default setup, for example) you'll need Version 6.*x* of the Microsoft Micro Assembler in order to recompile the program.

As an alternative to downloading, you can get a copy of the executable and its source code on-disk, without charge. Simply send a postcard or fax a request specifying program name and desired disk format, together with your name and address, to: Katherine West, Utilities, *PC Magazine,* One Park Avenue, New York, NY 10016. The fax request number is 212-503-5799; *no phone calls,* please.

All you need is your laser printer and a data file to print labels or envelopes to USPS standards. You can even create your own bar codes to speed delivery.

SETTING UP FOR MLPRINT MLPRINT is only a formatting and printing utility, so before sending a mailing list file to MLPRINT, you should use your database program to pick out the names to use and to arrange their address fields in the proper sequence. MLPRINT will do its most efficient and fastest processing on a file that matches the standard format specified by the USPS, an example of which is shown in Figure 1.

MLPRINT accepts ASCII files in which each line corresponds to a line to be printed on the label. Each line should be terminated by a carriage return and line-feed, and there must be one or more blank lines between each address record. MLPRINT uses a blank line to indicate the end of the address record, so you must make sure the address records do not insert blank lines in place of missing fields when you set up the file for MLPRINT. This can happen, for example, if your database is set up with multiple street lines to cover apartment numbers or mail stops.

To output an ASCII file that will be readable by MLPRINT, simply give your database a Print To Disk command. If your database or mailing list won't allow you to print to a file, it may give you the option of exporting to a file. On an export, you should be able to select the standard format. As a last resort, you can use a utility to capture the printer output from the database and send that to a file. PRN2FILE will do just fine. Download this program as PRN2FI.COM from the Utilities/Tips Forum on PC MagNet.

As is obvious from Figure 1, the Postal Service–approved address format is designed for efficient routing by OCR scanners, not for making a good initial impression on human recipients. For the sake of accurate scanner readings all letters are uppercased, and the only punctuation permitted is the hyphen in the ZIP+4 code at the end of the address. If the mailing address entries in your database file are kept in more conventional form, MLPRINT will convert to uppercase and replace the offending punctuation marks with spaces. Thus, for example, MLPRINT will transform

```
St. Paul, MN 46111
```

into

```
ST  PAUL  MN 46111
```

The order in which the address fields

are arranged is important. Starting from the bottom, the last line should contain the post office (city), state, and ZIP code. The spacing between the state and the ZIP code should be approximately one space with a monospaced font and between one and five em spaces (the width of the *m* character) if a proportional font is being used. Since MLPRINT uses the standard laser printer monospace Courier font, one space is sufficient.

Both for MLPRINT and for the Postal Service, the ZIP code must be the very last item in the address block; MLPRINT won't build a bar code unless it is. If for some reason the city or town is too long to fit, the ZIP code can be put on the last line by itself.

Immediately above the city, state, and ZIP line is the delivery address line, which contains the house number and street name (or box number). When the house or box number is incorporated within a Postnet bar code, the post office can directly route the letter closer to its actual destination—sometimes even to the actual floor or office.

In interpreting the delivery address line, MLPRINT follows the same rules as does the post office scanner. After read-

The Postnet Bar Code

Bar codes are everywhere. They're on almost everything we buy, thanks to the desire for automated checkouts. Hospitals use bar codes on a patient's bracelet for identification, and archaeologists use them to catalog rare specimens. The reason: fast and positive identification.

The speed and accuracy of modern bar code reading equipment similarly makes it possible to automate the routing systems of the Postal Service. Normally when an address is printed with a bar code, the bar code alone is used by the automatic scanning machinery to route your mail. Only if the bar code is missing or is, for some reason, unreadable or inaccurate does the post office scanner have to read the address block and print its own bar code. Manual methods are by and large passé.

Postnet stands for Postal Numeric Encoding Technique. It has evolved over the years since its introduction in 1976. The Postnet bar codes encode the numbers 0 through 9 with groups of five tall and short bars. The bars are printed in two heights:

Tall Bar—0.125 +/- 0.010"

Short Bar—0.050 +/- 0.010"

The width of each bar is 0.020 ±0.005 inch, and the spacing between them ranges from a 0.045-inch minimum to a 0.050-inch maximum. In Figure A the zero bits represent short bars, while the one bits represent the tall bars.

The numeric value of each set of five bars can be determined by summing the "weights" of the two tall bars; that is, by the one bits in the table. The weighting for the bit positions is 7,4,2,1,0. Thus if the pattern is 10010, the bits in positions 7 and 1 represent a value of 8.

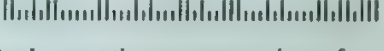
The Postnet code differs from bar codes such as UPC (grocery codes) and 3-of-9 (used for inventory systems) in that all the Postnet bars have the same width and spacing. This style is called a *clocked* bar code because the lower portion can be used as a standard "clock" as the code is scanned. The reader then does not have to rely on a completely steady scan to get accurate results.

When a ZIP or ZIP+4 is bar coded, the encoder adds one bar at the beginning and one bar at the end as *framing bars*. The framing bars are used as start and stop characters for the bar code reader. And to complete the encoded ZIP code, a check digit is calculated and added as the last full digit of the bar code. The check digit is the number that, when added to the sum of the other digits, brings the total up to the next number evenly divisible by 10.

MLPRINT uses an algorithm that adds up the ZIP code digits, divides it by 10, takes the remainder and subtracts that from 10. The result is the number of the check digit. Thus, for example, if the ZIP+4 is 46032-1123, the sum of the digits is 4+6+0+3+2+1+1+2+3 = 22. Take the modulus of the number relative to 10; that is, divide by 10 and keep only the remainder: (22 Mod 10=2). The remainder, 2, is subtracted from 10 leaving a check digit of 8.

The check digit is used if one of the digits in the bar code is unreadable due to a smudge or mark; the missing digit is calculated by the reverse of the original check digit calculation. The readable digit values are summed, including the check digit. The result is divided by 10, and the remainder is subtracted from 10. The value left afterwards is the value of the missing digit.

The illustration below shows the full bar code for the ZIP+4 80321-4093:



So the next time you see a piece of mail with a Postnet bar code, you can figure out how it got there.

—by Jay Munro

Postnet Chart of Values

Number	Bit Pattern
0	11000
1	00011
2	00101
3	00110
4	01001
5	01010
6	01100
7	10001
8	10010
9	10100

Figure A: **Unlike most bar codes, Postnet uses equal-width bars, whose lower portions provide a "clock" during scanning.**

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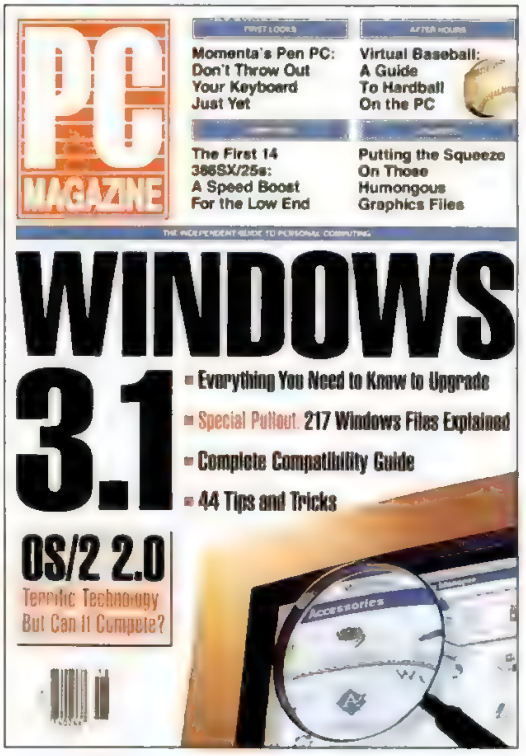

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The U.S. Postal Service's Address Format

Information/attention →	ATTN JOHN Q PUBLIC VP OF SALES
Name of recipient →	ZIP COMPUTER INC
Delivery address →	1234 FIFTH AVENUE SUITE 1
Post office (city), state, and ZIP code →	ANYTOWN IN 46001-1122

Figure 1: **The Postal Service's automation-compatible address format uses all-uppercase letters, with the lines arranged as shown. An optional nonaddress data line may be placed above the information/attention line.**

ing the delivery line from left to right, it examines the first block of characters up to the first space. If this block contains numbers, MLPRINT appends the last two contiguous digits (the delivery-point digits) to the Postnet bar code. If the scan does not produce a number at all, or if it finds that it contains nonnumeric characters (such as 125B, 32½ Main Street, or simply Maple Lane), the block is rejected and a 99 is appended to the Postnet code instead. The 99 signals the post office to look at the address more closely to determine the delivery point.

In setting up the fields in your mailing list database be sure to remember that the delivery address line—the line *immediately* above the city, state, and ZIP line—is the address to which the letter will be delivered. If your customer list has names with two addresses (one a box number and another a street address for UPS or Federal Express deliveries, for example) be sure to put the correct one on the delivery line, since the other one will be ignored.

Lines above the delivery address are not considered by MLPRINT, but the post office prefers them in the order shown in Figure 1. Omitted from that figure is an optional top line, called the nonaddress data line. The non-address data line can be used to hold customer-specific information such as the expiration date of a magazine or the tracking code for a particular advertisement.

USING MLPRINT Once your mailing list file is ready, setting up and using the MLPRINT utility is easy. Put the MLPRINT.COM executable either in a directory listed in your PATH statement or in the directory containing the text file created by your database. The second method lets you later specify the text file without typing in a long pathname. From the DOS prompt, enter the following:

```
MLPRINT
```

and the program's main screen will come up as shown in Figure 2.

The screen obviates the need to remember a string of command-line parameters for determining how and what is to be printed. All information is entered by typing a response and pressing Enter. By pressing the Up Arrow key you can return to a previous field; press the Down Arrow key or Enter if you want to skip forward. Your options, briefly, are

- Mailing List File: You can specify up to 50 characters for the path and filename of the mailing list text file created by your database. If you are running MLPRINT from the same directory as this file, just enter the filename and extension.
- Redirect to File?: If you hit Y rather than accept the default N answer to this question, MLPRINT will write the printer output to the filename you specify as the destination file. That file can then be printed later by copying it to the printer using the command:

```
COPY /b destfile LPT1:
```

The /b specifies a binary file and is needed to keep the printer control codes intact. Redirecting to a file is desirable if you are printing on a network and do not have direct control over the printer.

- Destination File: This field is used if you answered yes to the previous question. Again, you may specify up to 50 characters of path and filename. The field is ignored if redirection is not being used.
- Printer Port: MLPRINT can print to LPT1 or LPT2. If your laser printer is connected to the serial port, use the DOS MODE command to redirect. The normal MODE command for redirecting LPT1 to COM1 is this:

```
MODE COM1:9600,N,8,1,P
MODE LPT1=COM1
```

If your printer is on COM2, substitute that for COM1.

- Postnet Codes? Y/N: If it's appropriate for your mailing to use Postnet bar codes, you would override the default N and answer yes to this question. MLPRINT will use the laser printer's graphic resources to create a Postnet bar code, which will be printed as the top line of the address block.

The Postnet bar code is the little strip of vertical tall and short bars you see on most pieces of business mail. It is composed of sets of 5 lines, each set representing one digit. The standard Postnet bar code is based on the ZIP code in the address, so a 5-digit ZIP code requires a bar code of 25 lines. A 9-digit ZIP+4 code produces a 45-line bar code. MLPRINT also supports the Advanced Barcode, or ABC, which adds 2 more digits (10 lines). These are derived from the last 2 digits in the street address or box number of the delivery address line.

Added to the bar codes generated by the 5-, 9-, or 11-digit ZIP codes are a terminating correction digit and one tall *framing* bar at each end. (A correction digit is used by bar code scanners to reconstruct a missing digit. So if, for example, one of the digits in the bar code was smudged, the scanner can determine the missing digit using the corrections digit and the digits that it can read.) Thus, for a fully outfitted address with a street number and a ZIP+4, the total number of bars is 62. Further details about the encoding system are discussed in the sidebar "The Postnet Bar Code."

One warning about using bar codes on noncertified address lists should be given. If the ZIP+4 is incorrect, using the bar code can cause the letter to be routed automatically to the wrong location,

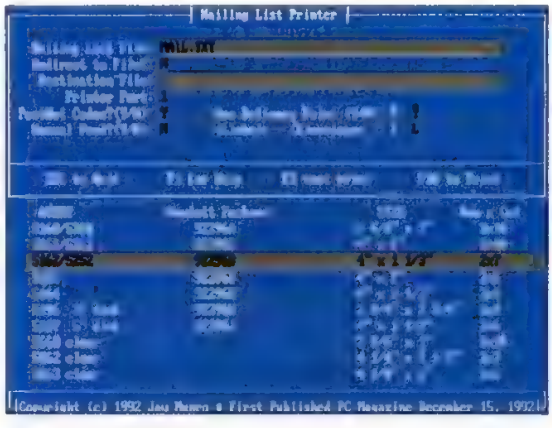

Figure 2: **The MLPRINT main screen lets you set printing choices without remembering a long string of command-line parameters.**

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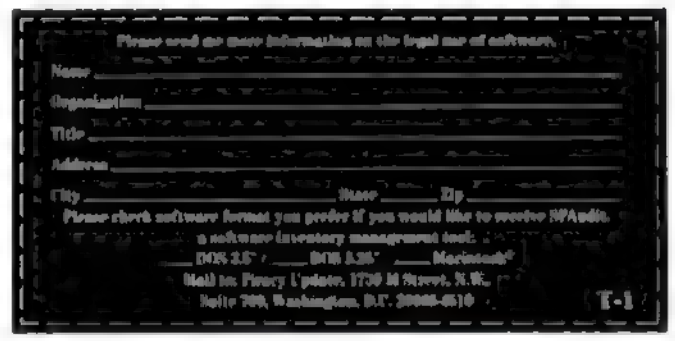

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Using a CASS-Certified Address List

When the U.S.Postal Service first developed the use of bar codes for routing mail, its purpose was to provide fast, accurate reading of ZIP+4 codes. Unfortunately, bar codes are only as good as the ZIP+4 codes they represent. The Postal Service offers its most highly discounted postal rates both on first and third class domestic mail to customers who not only bar code their own mail, but who use CASS-certified address lists as well. MLPRINT takes care of the bar coding aspect. CASS—the Coding Accuracy Support System—involves a certification process.

CASS certification can be done by the post office, by private services, or—if you use approved software—by yourself. The process involves checking your address list against the official USPS ZIP+4 database. To receive the best automation-based rates, your list must be better than 98 percent accurate when compared with the standard USPS lists. When a list is processed, the ZIP codes and addresses are checked for accuracy and are updated if needed.

As a postal customer, you must provide proof of CASS certification on your mailing list before the USPS will give you the automation discount. If you've ever received unsolicited mail that used ZIP+4, chances are the mailer processed your address for CASS certification. In the early days of ZIP+4 the post office offered CASS certification as a free service, without limit. With more and more private businesses offering the service, the Postal Service now limits its own certification to a one-time process. CASS-certified mailing lists have a one-year limitation, so you can get your list certified free for the first year, but thereafter will need to find a private service for processing.

CASS SOFTWARE DEVELOPERS

A software developer can get CASS certification for his list-processing software by submitting it to the National Change of Address office in Tennessee.

There is a charge based on the testing needed to verify that the software works. The least expensive procedure—$375 at this writing—is to appear in person to demonstrate and test your software. If you simply send the software to the office it will cost you $700 currently, and if you want a representative to come to your place of business, the charge is in the neighborhood of $1,000.

The aspect of the software that is CASS-certified is its ability match addresses to ZIP+4 codes, not how well it prints the address or bar code. The MLPRINT program cannot be CASS-certified for that reason, although the bar code it produces has been tested for readability. Once your software has been tested and certified, any mailing lists processed by it will be eligible for the full automation discounts.

CASS-certified mailing lists and bar coding are only two of the requirements to be met in order to obtain automation-based discounts. The USPS has complete specifications covering the physical size, color, material, and quantity required for bulk mail. For more information contact your local post office or postal business center, or contact the National Address Information Center at the numbers listed at the end of the main article.—*Jay Munro*

which can *add* several days to the delivery time. If in doubt, then it's better not to bother using the bar codes. The post office OCR equipment will read the address and print its own bar code.

Note that MLPRINT will not print a Postnet bar code if you accidentally slip in an international address or one without a ZIP code, or if the address block is not in the correct format.

- Use Delivery Point (Y/N): MLPRINT gives you the option of excluding the delivery point value for ZIP+4 bar codes. Although MLPRINT normally attempts to create a delivery point code for 9-digit ZIPs if you have specified yes to the previous question on using Postnet codes, you may prefer not to use these additional digits. One reason not to is if you are using 3-up labels: a 9-digit plus delivery point bar code is wider than a 2.5-inch label.
- Manual Feed (Y/N): Choosing yes for manual feed causes MLPRINT to send the LaserJet codes that require you to manually feed sheets rather than rely on the regular paper bin. This choice can be used for both labels and envelopes.
- <L>abels / <E>nvelopes: Hit an L for labels or an E for envelopes. Depending on the answer, MLPRINT will display an appropriate dialog box for further information as described below.

LABELS The Label screen presents you with a list of Avery and Hewlett-Packard part numbers and dimensions for the majority of popular configurations. Labels intended for a sheet-fed dot matrix printer may be cheaper, but they may not hold to their backing under the heat of a laser printer. Avery and HP both market high-quality labels designed specifically for laser printers. Trying to save a few cents on labels could wind up costing you a bundle in printer repairs.

MLPRINT does not test the length of the lines in your addresses. Although this is probably of little concern when printing envelopes, if you're using labels you must be sure they are wide enough for all your address fields.

MLPRINT uses the standard 10-pitch (12-point) monospace Courier font, which prints 10 characters per inch horizontally and 6 lines per inch vertically. That makes it easy to determine the size of labels to use. If address fields are set for 40 characters, you should use 4-inch-wide labels; if you only have 25 characters, you can use 2.5-inch-wide labels. On this basis you know that a 1- by 4-inch label will hold 6 lines of 40 characters.

Remember to allocate a line for a bar code if you plan to have MLPRINT add one, however. MLPRINT puts the Postnet bar code on the first line of the label and then prints the address. For a personal holiday card list, the six lines of a 1-inch label will undoubtedly be more than ample, but on a business mailing you may need to use a larger label.

The Up and Down Arrow keys move the screen highlight among the various label choices MLPRINT supports. When

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you hit Enter to confirm your selection, MLPRINT sets itself up for the size, spacing, and number of labels per sheet. When using multicolumn labels, MLPRINT works from left to right, one row at a time.

If you are not sure you have selected the correct label format, put a regular piece of paper into your laser printer and press F2 to print a full test sheet. Then simply lay the test sheet atop a sheet of labels and hold them up to a light. This will confirm whether the labels line up with the test prints or not.

Once you've determined that everything is properly set up, you print your labels by pressing F10.

ENVELOPES MLPRINT's Envelope screen also provides a number of setup options. The first is whether you wish to print your return address. The default N presumes that you will normally use envelopes with a preprinted return address. Next you must indicate whether your laser printer feeds envelopes from the center or from the right side: On a LaserJet III, single-fed envelopes are centered; on a LaserJet IIIP, however, they are flush right. In either case, envelopes are fed with the flap on the left.

Your third choice is among the various envelope sizes MLPRINT supports. Note that if you decide to print a Postnet bar code, MLPRINT will place it above the regular address block to allow you more flexibility in choosing envelopes. (The Postal Service permits the alternative of printing the bar code in the "Postnet Clear Zone," an area of 4½inches from the right edge and ⅝ inch up from the bottom edge of the envelope.)

Finally, if you have elected to print a return address you will be prompted to type it into the field provided. Up to 6 lines of 40 characters each can be entered in this block.

PRINTING After checking that you've specified the right parameters and that your printer is on and full of labels or envelopes, press F10 to start printing. Any printer or source file errors will be displayed on the screen. You're likely to get one of two error messages eventually depending on your hardware: "Out of Paper"or "Printer Not Responding." When either of these occurs, just refill the printer and press Enter. All error messages give you the same choices: Enter to try again and continue, or ESC to quit.

MLPRINT will read and print the whole address file you have specified, stopping only for refills as needed. When complete, if you are printing labels MLPRINT will eject the last page even if all the labels are not printed. When using a laser printer there is no way to print less than a full sheet of labels and save the rest of the sheet to use at a later date.

HOW MLPRINT WORKS MLPRINT is written in assembly language, using several features that are unique to the Microsoft Macro Assembler (MASM), Version 6.0. The MASM 6 Proto/Invoke conventions provide an easy way of creating and calling subprocedures in much the same way as C or BASIC, and MLPRINT is built with a series of subprocedures that are called from a main module. MASM 6 also provides a simplified syntax for assigning default segments and creating setup code for the executable program. When you specify the new Tiny model with compiling and linking, MASM 6 creates the standard .COM format by setting all segments—DS, ES, and SS—equal to the Code segment. This eliminates the extra step of using EXE2BIN to create the .COM file.

MLPRINT starts by asking the user to supply the appropriate printing parameters. When this is done and the user presses F10, the program opens the specified text file. An error routine is called and the user is given the option to continue or exit if an error occurs at any point. The size of the text file is stored for tracking as the labels are printed. If the text file is smaller than 2K, the entire file is read. The text file is read into a buffer in 2,048-byte portions, and the amount read is subtracted from the total size of the file.

As the portions are read in, MLPRINT scans the buffer for delimiters and copies the address lines into a local print buffer. When it reaches the end of the address record, the program moves on to formatting the printer output. The print buffer is then processed to capitalize everything, replace punctuation characters with spaces, and remove extra spaces. If the address is a ZIP+4 code, MLPRINT puts a hyphen between the fifth and sixth digits. At this time if Postnet codes are not specified, the label or envelope is printed. However if Postnet codes are to be used, this is when the interesting work begins.

MLPRINT needs two pieces of infor-

PC Magazine Utilities Updates

As with all good software, the programs presented in *PC Magazine* are upgraded and improved. Here's a partial list of the programs on PC MagNet that have been updated. To download these files from the Utilities/Tips Forum, type GO ZNT:TIPS; type LIB or select Libraries from the menu; then select Library 2 PCMAG UTILS. Type DOW and the filename listed below (for example, DOW ANSI.COM), or select Download a File from the menu.

ADDIT.COM, Version 1.1
ANSI.COM, Version 1.3
BAT2EXEC.COM, Version 1.5
BCOPY, Version 1.2
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.7
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 3.1
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PCACCESS.EXE, Version 1.1
RN.COM, Version 3.0
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.4

For a complete list of the programs that are available on PC MagNet, download PCMCAT.ZIP from Library 0 (New Uploads) of the Utilities/Tips Forum.

A downloadable index to *PC Magazine*'s product reviews is also available in Library 1 (General Info). PCM.EXE is a self-extracting file containing the Computer Library *PC Magazine* Reviews Index for January 1988 through December 1991. It requires the search files in PCSRCH.EXE.

Utilities by Modem

The *PC Magazine* utilities are available by modem from PC MagNet, a ZiffNet service hosted by CompuServe.

To find the phone number nearest you, set your communications software to 300, 1,200, 2,400, or 9,600 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex, then dial 800-346-3247 with your modem. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you. Or you can call 800-635-6225 (voice) and follow the instructions and note the number.

To obtain the current issue's utility free of charge: Dial the local number; at the HOST NAME prompt, type CIS; and at the USER ID prompt, enter 60116,1. Then at the PASSWORD prompt, enter PCMAGUTIL.

To join ZiffNet: At the USER ID prompt, type 177000,5000. Then, at the PASSWORD prompt, enter PC*MAGNET. Finally, at the ENTER AGREEMENT NUMBER prompt, type PCMAG92.

Register your name and enter your American Express, MasterCard, or Visa number. (If you'd like to have your company billed instead, call CompuServe at 800-848-8990.) Your personal user ID and a temporary password will be displayed. A new password will arrive in the mail within ten days to confirm your subscription.

ZiffNet membership costs $2.50 per month. This includes access to *PC Magazine* Editors' Choice Awards, Product Reviews index, Weekly News from *PC Week*, Buyers' Market, ZiffNet Highlights, and the Support Forum (which also includes the current utility). CompuServe members can join by entering GO PCMAG at any CompuServe ! prompt.

Outside of these areas, PC MagNet costs $6.30 per hour for 300-bps service; $12.80 for 1,200 or 2,400 bps; and $22.80 for 9,600 bps. Billing is based on 1-minute increments.

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QUICK REFERENCE CARD

MLPRINT.COM

Jay Munro December 8, 1992 (Utilities)

Purpose: Formats and prints mailing address labels or envelopes from an ASCII text file on an HP LaserJet or compatible printer, optionally adding standard Postnet bar codes.

Format: `MLPRINT`

Remarks: In place of command-line parameters, MLPRINT uses setup screens for entering the Mailing List filename and the filename to accept redirected printer output, if desired. LPT1 and LPT2 printer ports are supported, and serial printers can use redirection to access them. Manual or paper-tray feed can be used, as can LaserJets that feed envelopes from either the center or the right side. Postnet codes, if selected, can be generated for 5-digit and 9-digit ZIP codes. ZIP+4 codes can also optionally be expanded to include the ABC (Advanced Barcode) system, which supplies delivery point information as well.

Ten commonly used sizes of laser printer labels and five envelope sizes are selectable, and envelopes can optionally include a return address of up to 6 lines of 40 characters each. MLPRINT uses the laser printer Courier font, which prints 10 characters per inch and 6 lines per inch.

To conform to postal requirements, suitable ASCII mailing list files should follow the label format below:

```
ATTN JOHN Q PUBLIC VP OF SALES
ZIP COMPUTER INC
1234 FIFTH AVENUE SUITE 1
ANYTOWN IN 46001-1122
```

Each line must be terminated in a carriage return/line feed, and one or more blank lines are used to separate different address records. Blank lines must not be used in place of omitted fields.

MLPRINT will automatically uppercase letters and remove punctuation, as shown. The ZIP code must be the final item in the bottom line, and any street or box numbers must be the first item in the line next to the bottom. When a bar code is generated it is printed above the address block.

Compiling the source code, MLPRINT.ASM, requires use of the Microsoft Macro Assembler, Version 6.*x*.

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PC-12/92

CIRCLE 089 ON READER SERVICE CARD

mation to build the Postnet bar code: the ZIP code and the delivery point number. The ZIP code is parsed from the last line of the address block and is checked for the correct number of digits. If it's a 5-digit ZIP code it is stored for bar coding, after which the address is printed. A 9-digit ZIP code is also parsed and stored, but in this case MLPRINT then looks to the delivery address line to find the delivery point number.

MLPRINT reads the delivery address line from left to right, scanning for a number to use as the delivery point number as described earlier in the article. If MLPRINT can't fit the number into one of these rules, the number 99 is used as the code. The delivery point bar code is used only with ZIP+4 addresses.

Printing the address labels is relatively straightforward. MLPRINT opens the printer as a device in Raw mode. Character-based devices such as printers are normally handled by DOS in Cooked mode, which means that the port filters end-of-file and other control characters and interprets them instead of passing them on to the device. But since

Since MLPRINT will be sending printer codes, it uses Raw instead of Cooked mode.

MLPRINT will be sending printer codes, DOS shouldn't tamper with what is sent, so MLPRINT uses Raw mode. In Raw mode the port just passes everything through to the device without filtering.

Setting Raw mode is done in two steps. First use INT 21h, function 44h, subfunction 00 to obtain the current device information. The device information word contains more data than is needed, but it's necessary in order to change the Cooked/Raw flag (bit 5). It is set if it is in Raw Mode, cleared if it is in Cooked Mode. After setting bit 5 and without disturbing the other bits, INT 21h, function 44, subfunction 1 is called to set the information just changed. Raw mode is comparable to copying a file to the printer using the /b argument.

Everything but the return address is

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LAS VEGAS, NV (MGX) — Anybody not playing "the event" of **COMDEX 1992** obviously had plans they couldn't change. Because this concert will be remembered as the year that Hollywood and Silicon Valley converged in a spectacular fusion of entertainment and technology. Presented by **Micrografx** and produced by the **Walt Tucker Group**, the **Grand Scientific Musical Theater** combines great performers with the future of modern production. This event sets the standard for multimedia entertainment. Best of all, the proceeds will go to the **National Center For Missing & Exploited Children (NCMEC)**.

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printed from data stored in the MLPRINT data area. Because the program is so data intensive, I used a shortcut by reading the return address directly from the screen template and sending it

MLPRINT can help you on your way to a better and perhaps more profitable mailing plan.

to the printer as a printer macro. The macro is then called each time an envelope is printed, eliminating the time it would normally take to send the return address to the printer repeatedly.

The graphic instructions for the bar codes are also downloaded into the laser printer's memory as macros. MLPRINT creates each number, 0 through 9, as a macro and simply calls it as needed, again saving on transfer time. The graphic instructions for the bar codes use the line drawing capability of the HP LaserJet, and they are executed at the current printer cursor position.

MORE INFORMATION Coupled with complete (ZIP+4) addressing, the right materials, and a well-prepared database file, MLPRINT will have you on your way to a better and perhaps more profitable mailing plan.

The Postal Service provides information for business mailers in the form of brochures, worksheets, and even an entertaining text and graphics software package. This last, called Mail Flow Planning System, is an information-packed guide for preparing your mailings. It even includes an "exam" in which you choose the type of mailing and addressing you think is best and then see how well your letter progresses through the electronic post office. The following USPS publications will help you toward obtaining economical service:

- *Automation Plan for Business Mailers* (Publication 67);
- *A Guide to Business Mail Preparation* (Publication 25);
- *U.S.P.S. Mail Flow Planning System* (Version 2.3 Software).

If you are more interested in writing software that uses the Postnet bar coding process, you can contact the National Address Information Center, United States Postal Service, 6060 Primacy Pkwy., Ste. 101, Memphis, TN 38188-0001; 800-331-5746.

For information on CASS-certified services and products, call 800-238-3150 or in Tennessee, 800-233-0453.

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JAY MUNRO IS A FREQUENT CONTRIBUTOR TO *PC MAGAZINE*.

CIRCLE 307 ON READER SERVICE CARD

Enumerating Fonts Under OS/2 2.0

BY CHARLES PETZOLD

Working with fonts sometimes reminds me of the Monty Python routine about the cheese shop. A customer requests a certain kind of cheese, but the shop doesn't have it. He asks for another kind, and another, and then another, eventually requesting more than 40 kinds of cheese. The shop doesn't have any of them and, finally, the customer shoots the proprietor.

Similarly, I can imagine a font-hungry application running under Windows or the OS/2 Presentation Manager (PM) requesting one specific font after another and coming up empty: Garamond? No. New Century Schoolbook? No. Goudy Old Style? No. New Baskerville? No. Avant Garde Gothic? No. Helvetica Narrow? No. This could go on and on, considering that there are over 10,000 font designs.

Of course, Times, Helvetica, and Courier are the Cheddar, Swiss, and American of fonts. But even these popular designs might not be available on some output devices under their licensed names. For example, the TrueType version of Helvetica in Windows 3.1 is called Arial, and the version of Times in OS/2 2.0 is called Times New Roman.

It's much more useful to first find out which fonts are available on an output device and then to select from among them. Determining available fonts is often called *font enumeration.* This is important stuff: The proprietor of that cheese shop might be alive today had he first properly enumerated the available cheeses to the customer.

NO MIDDLE GROUND Despite the importance of font enumeration, an OS/2 2.0 program can select different fonts without first enumerating them. You fill the fields of a FATTRS (font attributes) structure and pass a pointer to this structure to GpiCreateLogFont. But this technique doesn't always work very well. The OS/2 2.0 GPI (Graphics Programming Interface) supports both bitmap fonts and scalable outline fonts in the Adobe Type 1 font format (as I discussed in the last issue), but the FATTRS structure and GpiCreateLogFont work a little differently for bitmap fonts and outline fonts.

If you want to select a bitmap font, you must initialize the FATTRS structure with the font face name, the "baseline extent" (which, as we'll learn in the next issue, is a little larger than the font height in points), and the average character width. These values must match those of an existing bitmap font exactly. If no match exists, you get the default system font. In short, unless you hard-code bitmap font sizes in your program—and keep in mind that they vary by video resolution—you have little chance of getting GpiCreateLogFont to work the way you want. Font enumeration is a practical necessity for bitmap fonts.

Since OS/2 has no mechanism for making font substitutions, applications must be able to determine the fonts available on an output device. This sample program demonstrates how.

You'll have much better luck if you want to select a scalable outline font with GpiCreateLogFont. All you need to know for setting up the FATTRS structure is the font face name. You can hard-code the face names of the 13 standard OS/2 outline fonts in your program (these were listed in the last issue). This might be a reasonable approach if you want to display richly formatted text using only Courier, Helvetica, and Times New Roman fonts in bold and italic versions.

If you're familiar with font selection under Windows, you're probably aware of the Windows font mapper, which attempts to find a font that comes closest to the one requested. When you need a font, you can specify both a face name and a font family code. Windows supports five families: Modern (fixed-pitch), Swiss (sans serif), Roman (serif), Script, and Decorative. (Don't confuse the Windows font family with the typeface family name.) So, for example, you can specify Helvetica as the face name and Swiss as the family. If Helvetica isn't available but Avant Garde (another sans serif font) is, you'll get the Avant Garde font instead. And you don't need to specify exact font sizes for bitmap fonts; if the requested size isn't available, the font mapper will find the closest (smaller) size.

The OS/2 Presentation Manager has no font-mapping algorithm. There's no way for the GPI to make a font substitution if nothing matches the information in the FATTRS structure. Thus, there is no middle ground between precisely specifying a requested font, and enumerating available fonts and selecting from them.

Enumerating fonts is also necessary if you want to let users select a particular font from a menu or dialog box. You can either do the enumeration yourself or let the standard font dialog box included in OS/2 2.0 do it for you.

USING GPIQUERYFONTS To enumerate fonts, you use the GPI function GpiQueryFonts. The syntax of this function is a little awkward when examined out of

context of sample code, so let's first see how the function is commonly used, and then we can look at the variations.

I'll assume you have a handle to a presentation space stored in a variable named hps. This presentation space is associated with a device context for either the video display or a printer. You want to get information about all the fonts available on that device. The information will be returned to you as an array of FONTMETRICS structures. This structure is one of the largest in OS/2. It has 52 fields, the last of which is another structure containing 11 fields.

The first step is to determine the number of fonts available on the device. You need a LONG (32-bit) variable; let's name it lFonts. Set lFonts equal to zero and then call GpiQueryFonts like so:

```
lFonts = 0 ;
lFonts = GpiQueryFonts (hps,
 QF_PUBLIC, NULL, &lFonts, 0,
 NULL) ;
```

Notice that a pointer to lFonts is passed to the function, and that lFonts also stores the function's return value. On return from GpiQueryFonts, lFonts will equal the total number of fonts available.

Next, you allocate a block of memory sufficient for an array of this many FONTMETRICS structures. You need a variable defined as a pointer to a FONTMETRICS structure:

```
PFONTMETRICS pfm ;
```

Then you allocate the memory using your favorite memory allocation function:

```
pfm = (PFONTMETRICS) calloc
  (lFonts, sizeof (FONTMETRICS)) ;
```

Just to give you some idea of the size of this memory block, the FONTMETRICS structure is 228 bytes in length, and lFonts will be at least 41 when using a video presentation space. (The 41 fonts are the System Proportional font, the 4 System Monospaced fonts, the 3 Courier fonts, the 6 Tms Rmn fonts, the 6 Helv bitmap fonts, the 13 Adobe Type 1 outline fonts, and the 4 Tms Rmn and 4 Helv face names that duplicate the Times New Roman and Helvetica Type 1 fonts.)

Now you call GpiQueryFonts a second time with the pfm pointer and the lFonts variable set in the first step:

```
GpiQueryFonts (hps, QF_PUBLIC,
 NULL, &lFonts, sizeof
 (FONTMETRICS), pfm) ;
```

After this call, you can index the pfm pointer and access the fields of the FONTMETRICS structure for each font.

GPIQUERYFONTS'S SYNTAX The general syntax of GpiQueryFonts is:

```
lRemFonts = GpiQueryFonts (hps,
 flOptions, pszFacename,
 &lReqFonts, lMetricsLen, pfm)
```

The fourth parameter is a pointer to a LONG variable, which must be set to the number of requested fonts. If lReqFonts is greater than the number of available fonts, the function will set the variable equal to the actual number of fonts. (You could then call realloc to shrink the memory block pointed to by pfm.) If lReqFonts is less than the number of available fonts, the function returns the number of remaining fonts in lRemFonts. There's no way, however, to find out about those remaining fonts unless you call the function again requesting all the fonts.

In the example above, the GpiQueryFonts function was first called requesting 0 fonts. In this case, the last two parameters can be set to 0 and NULL. The function returns the number of remaining fonts, which is the total number of fonts.

The second parameter can be one or more flags beginning with the prefix QF. The QF_PUBLIC flag used in the example indicates you want the fonts that are loaded by the OS/2 Presentation Manager during startup and that are available to all PM applications. (PM

FONTLIST.C

1 of 3

```
/*--------------------------------------------------------------
   FONTLIST.C -- Font Lister for OS/2 2.0 Presentation Manager
                 (c) Charles Petzold, 1992
  --------------------------------------------------------------*/

#define INCL_WIN
#define INCL_GPI
#include <os2.h>
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include "fontlist.h"

MRESULT EXPENTRY ClientWndProc (HWND, ULONG, MPARAM, MPARAM) ;

int main (void)
     {
     static CHAR  szClientClass [] = "FontList" ;
     static ULONG flFrameFlags = FCF_TITLEBAR      | FCF_SYSMENU   |
                                 FCF_SIZEBORDER    | FCF_MINMAX    |
                                 FCF_SHELLPOSITION | FCF_TASKLIST  |
                                 FCF_MENU          | FCF_HORZSCROLL ;
     HAB          hab ;
     HMQ          hmq ;
     HWND         hwndFrame, hwndClient ;
     QMSG         qmsg ;

     hab = WinInitialize (0) ;
     hmq = WinCreateMsgQueue (hab, 0) ;

     WinRegisterClass (hab, szClientClass, ClientWndProc, CS_SIZEREDRAW, 0) ;

     hwndFrame = WinCreateStdWindow (HWND_DESKTOP, WS_VISIBLE,
                                     &flFrameFlags, szClientClass,
                                     "Font Lister", 0L,
                                     NULLHANDLE, ID_RESOURCE, &hwndClient) ;

     while (WinGetMsg (hab, &qmsg, NULLHANDLE, 0, 0))
          WinDispatchMsg (hab, &qmsg) ;

     WinDestroyWindow (hwndFrame) ;
     WinDestroyMsgQueue (hmq) ;
     WinTerminate (hab) ;
     return 0 ;
     }

/* Functions for obtaining the printer DC and PS
   ---------------------------------------------*/

HDC OpenDefaultPrinterDC (HAB hab)
     {
     static CHAR     achPrnData[256] ;
     static DRIVDATA driv = { sizeof (DRIVDATA) } ;
     CHAR            achDefPrnName[33], *pchDelimiter ;
     DEVOPENSTRUC    dop ;

               // Obtain default printer name and remove semicolon

     PrfQueryProfileString (HINI_PROFILE, "PM_SPOOLER",
                            "PRINTER", ";",
                            achDefPrnName, sizeof achDefPrnName) ;

     if ((pchDelimiter = strchr (achDefPrnName, ';')) != NULL)
          *pchDelimiter = '\0' ;

     if (achDefPrnName[0] == '\0')
          return DEV_ERROR ;

               // Obtain information on default printer
```

Figure 1: **This is the source code listing for FONTLIST, a program for enumerating fonts under OS/2 2.0.**

FONTLIST.C

2 of 3

```
PrfQueryProfileString (HINI_PROFILE, "PM_SPOOLER_PRINTER",
                       achDefPrnName, ";;;;",
                       achPrnData, sizeof achPrnData) ;

          // Parse printer information string

if ((pchDelimiter = strchr (achPrnData, ';')) == NULL)
     return DEV_ERROR ;

dop.pszDriverName = pchDelimiter + 1 ;

if ((pchDelimiter = strchr (dop.pszDriverName, ';')) == NULL)
     return DEV_ERROR ;

dop.pszLogAddress = pchDelimiter + 1 ;

*(dop.pszLogAddress + strcspn (dop.pszLogAddress, ",;")) = '\0' ;
*(dop.pszDriverName + strcspn (dop.pszDriverName, ",;")) = '\0' ;

          // Fill DRIVDATA structure if necessary

if ((pchDelimiter = strchr (dop.pszDriverName, '.')) != NULL)
     {
     *pchDelimiter = '\0' ;
     strncpy (driv.szDeviceName, pchDelimiter + 1,
                                 sizeof (driv.szDeviceName)) ;
     dop.pdriv = &driv ;
     }
else
     dop.pdriv = NULL ;

          // Set data type to "std"

     dop.pszDataType = "PM_Q_STD" ;

          // Open printer device context

     return DevOpenDC (hab, OD_INFO, "*", 4L, (PDEVOPENDATA) &dop, 0L) ;
     }

HPS CreatePrinterPS (HAB hab, HDC hdcPrinter)
     {
     SIZEL sizlPage ;

     sizlPage.cx = 0 ;
     sizlPage.cy = 0 ;

     return GpiCreatePS (hab, hdcPrinter, &sizlPage,
                         PU_PELS     | GPIF_DEFAULT |
                         GPIT_MICRO  | GPIA_ASSOC) ;
     }

/* Macro and functions for formatting the data
   ------------------------------------------*/

#define FORMAT(field, format)  iLen += sprintf (pchBuffer + iLen,       \
                                                "  " #field format "\n", \
                                                pfm1->##field,          \
                                                pfm2->##field) ;

void FormatData (CHAR * pchBuffer, PFONTMETRICS pfm1, PFONTMETRICS pfm2)
     {
     INT  iLen ;

     iLen = 0 ;

     FORMAT (szFamilyname, ":          %s") ;
     FORMAT (szFacename, ":            %s\n") ;

     FORMAT (idRegistry, ":            %6hu") ;
     FORMAT (usCodePage, ":            %6hu\n") ;

     FORMAT (lEmHeight, ":             %6ld  %6ld") ;
     FORMAT (lXHeight, ":              %6ld  %6ld") ;
     FORMAT (lMaxAscender, ":          %6ld  %6ld") ;
     FORMAT (lMaxDescender, ":         %6ld  %6ld") ;
     FORMAT (lLowerCaseAscent, ":      %6ld  %6ld") ;
     FORMAT (lLowerCaseDescent, ":     %6ld  %6ld") ;
     FORMAT (lInternalLeading, ":      %6ld  %6ld") ;
     FORMAT (lExternalLeading, ":      %6ld  %6ld") ;
     FORMAT (lAveCharWidth, ":         %6ld  %6ld") ;
     FORMAT (lMaxCharInc, ":           %6ld  %6ld") ;
     FORMAT (lEmInc, ":                %6ld  %6ld") ;
     FORMAT (lMaxBaselineExt, ":       %6ld  %6ld\n") ;

     FORMAT (sCharSlope, ":              %04hX") ;
     FORMAT (sInlineDir, ":              %04hX") ;
     FORMAT (sCharRot, ":                %04hX\n") ;

     FORMAT (usWeightClass, ":         %6hu") ;
     FORMAT (usWidthClass, ":          %6hu\n") ;

     FORMAT (sXDeviceRes, ":           %6hd") ;
     FORMAT (sYDeviceRes, ":           %6hd\n") ;

     FORMAT (sFirstChar, ":            %6hd") ;
     FORMAT (sLastChar, ":             %6hd") ;
     FORMAT (sDefaultChar, ":          %6hd") ;
     FORMAT (sBreakChar, ":            %6hd\n") ;

     FORMAT (sNominalPointSize, ":     %6hd") ;
     FORMAT (sMinimumPointSize, ":     %6hd") ;
     FORMAT (sMaximumPointSize, ":     %6hd\n") ;

     FORMAT (fsType, ":                  %04hX") ;
     FORMAT (fsDefn, ":                  %04hX") ;
     FORMAT (fsSelection, ":             %04hX") ;
     FORMAT (fsCapabilities, ":          %04hX\n") ;

     FORMAT (lSubscriptXSize, ":       %6ld  %6ld") ;
     FORMAT (lSubscriptYSize, ":       %6ld  %6ld") ;
     FORMAT (lSubscriptXOffset, ":     %6ld  %6ld") ;
     FORMAT (lSubscriptYOffset, ":     %6ld  %6ld") ;
     FORMAT (lSuperscriptXSize, ":     %6ld  %6ld") ;
     FORMAT (lSuperscriptYSize, ":     %6ld  %6ld") ;
     FORMAT (lSuperscriptXOffset, ":   %6ld  %6ld") ;
     FORMAT (lSuperscriptYOffset, ":   %6ld  %6ld") ;
     FORMAT (lUnderscoreSize, ":       %6ld  %6ld") ;
     FORMAT (lUnderscorePosition, ":   %6ld  %6ld") ;
     FORMAT (lStrikeoutSize, ":        %6ld  %6ld") ;
     FORMAT (lStrikeoutPosition, ":    %6ld  %6ld\n") ;

     FORMAT (sKerningPairs, ":         %6hd") ;
     FORMAT (sFamilyClass, ":          %6hd\n") ;

     FORMAT (lMatch, ":                %6ld\n") ;

     FORMAT (FamilyNameAtom, ":        %6lu") ;
     FORMAT (FaceNameAtom, ":          %6lu\n") ;

     FORMAT (panose.bFamilyType, ":    %6hd") ;
     FORMAT (panose.bSerifStyle, ":    %6hd") ;
     FORMAT (panose.bWeight, ":        %6hd") ;
     FORMAT (panose.bProportion, ":    %6hd") ;
     FORMAT (panose.bContrast, ":      %6hd") ;
     FORMAT (panose.bStrokeVariation, ": %6hd") ;
     FORMAT (panose.bArmStyle, ":      %6hd") ;
     FORMAT (panose.bLetterform, ":    %6hd") ;
     FORMAT (panose.bMidline, ":       %6hd") ;
     FORMAT (panose.bXHeight, ":       %6hd") ;
     FORMAT (panose.abReserved[0], ":  %6hd") ;
     FORMAT (panose.abReserved[1], ":  %6hd") ;
     }

BOOL SetDataInWindow (HWND hwndEdit, PFONTMETRICS pfm1, PFONTMETRICS pfm2)
     {
     CHAR * pchBuffer ;

     if (NULL == (pchBuffer = (CHAR *) malloc (10000)))
          return FALSE ;

     FormatData (pchBuffer, pfm1, pfm2) ;
     WinSetWindowText (hwndEdit, pchBuffer) ;
     free (pchBuffer) ;

     return TRUE ;
     }

/* Function for enumerating all fonts in device units and decipoints
   ----------------------------------------------------------------- */

LONG GetAllFonts (HPS hps, PFONTMETRICS * ppfm1, PFONTMETRICS * ppfm2)
     {
     HDC          hdc ;
     LONG         lFonts, xDis, yDis, xRes, yRes ;
     PFONTMETRICS pfm1, pfm2 ;
     SIZEL        sizl ;

          // Find number of fonts

     lFonts = 0 ;
     lFonts = GpiQueryFonts (hps, QF_PUBLIC, NULL, &lFonts, 0, NULL) ;

     if (lFonts ==  0)
          return 0 ;

          // Allocate memory for FONTMETRICS structures

     pfm1 = (PFONTMETRICS) calloc (lFonts, sizeof (FONTMETRICS)) ;

     if (pfm1 == NULL)
          return 0 ;

     pfm2 = (PFONTMETRICS) calloc (lFonts, sizeof (FONTMETRICS)) ;

     if (pfm2 == NULL)
          {
          free (pfm1) ;
          return 0 ;
          }

          // Get font information in device units

     GpiQueryFonts (hps, QF_PUBLIC, NULL, &lFonts,
                         sizeof (FONTMETRICS), pfm1) ;

          // Switch world coordinates to decipoints
```

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FONTLIST.C

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```
     hdc = GpiQueryDevice (hps) ;

     DevQueryCaps (hdc, CAPS_WIDTH,                1, &xDis) ;
     DevQueryCaps (hdc, CAPS_HEIGHT,               1, &yDis) ;
     DevQueryCaps (hdc, CAPS_HORIZONTAL_FONT_RES, 1, &xRes) ;
     DevQueryCaps (hdc, CAPS_VERTICAL_FONT_RES,    1, &yRes) ;

     sizl.cx = (720 * xDis + 0.5) / xRes ;
     sizl.cy = (720 * yDis + 0.5) / yRes ;
     GpiSetPS (hps, &sizl, PU_ARBITRARY) ;

               // Get font information in decipoints

     GpiQueryFonts (hps, QF_PUBLIC, NULL, &lFonts,
                    sizeof (FONTMETRICS), pfm2) ;

     * ppfm1 = pfm1 ;
     * ppfm2 = pfm2 ;

     return lFonts ;
     }

MRESULT EXPENTRY ClientWndProc (HWND hwnd, ULONG msg, MPARAM mp1, MPARAM mp2)
     {
     static FATTRS       fat = { sizeof (FATTRS), 0, 0, "System Monospaced" } ;
     static HAB          hab ;
     static HWND         hwndEdit, hwndMenu, hwndScroll ;
     static LONG         lFonts, lFont ;
     static PFONTMETRICS pfm1, pfm2 ;
     static SHORT        sDevice = IDM_SCREEN ;
     HDC                 hdc, hdcPrinter ;
     HPS                 hps, hpsPrinter ;
     LONG                i, xRes, yRes ;

     switch (msg)
        {
          case WM_CREATE:
               hab = WinQueryAnchorBlock (hwnd) ;

                         // Create MLE window

               hwndEdit = WinCreateWindow (hwnd, WC_MLE, NULL,
                              WS_VISIBLE | MLS_VSCROLL | MLS_READONLY,
                              0, 0, 0, 0, hwnd, HWND_TOP, 1, NULL, NULL) ;

                         // Get the array of FONTMETRICS structures

               hps = WinGetPS (hwnd) ;
               lFonts = GetAllFonts (hps, & pfm1, & pfm2) ;

                         // Set the edit control for a system monospaced font

               hdc = GpiQueryDevice (hps) ;

               DevQueryCaps (hdc, CAPS_HORIZONTAL_FONT_RES, 1, &xRes) ;
               DevQueryCaps (hdc, CAPS_VERTICAL_FONT_RES,   1, &yRes) ;

               WinReleasePS (hps) ;

               for (i = 0 ; i < lFonts ; i++)
                    if (!strcmp (pfm1[i].szFacename, fat.szFacename) &&
                        pfm1[i].sXDeviceRes == xRes &&
                        pfm1[i].sYDeviceRes == yRes)
                        {
                        fat.lMaxBaselineExt = pfm1[i].lMaxBaselineExt ;
                        fat.lAveCharWidth   = pfm1[i].lAveCharWidth ;
                        }

               WinSendMsg (hwndEdit, MLM_SETFONT, (MPARAM) & fat, NULL) ;

                         // Set the first FONTMETRIC as the edit text

               if (lFonts > 0)
                    SetDataInWindow (hwndEdit, pfm1, pfm2) ;

                         // Set horizontal scrollbar range

               hwndScroll = WinWindowFromID (WinQueryWindow (hwnd, QW_PARENT),
                                             FID_HORZSCROLL) ;

               WinSendMsg (hwndScroll, SBM_SETSCROLLBAR,
                           MPFROM2SHORT (lFont, 0),
                           MPFROM2SHORT (0, lFonts - 1)) ;

                         // Get menu window handle

               hwndMenu = WinWindowFromID (WinQueryWindow (hwnd, QW_PARENT),
                                           FID_MENU) ;
               return 0 ;

          case WM_SIZE:
                         // Set new MLE window size

               WinSetWindowPos (hwndEdit, NULLHANDLE,
                                0, 0, SHORT1FROMMP (mp2), SHORT2FROMMP (mp2),
                                SWP_MOVE | SWP_SIZE) ;
               return 0 ;

          case WM_COMMAND:
                         // Menu commands -- get new font data

               WinCheckMenuItem (hwndMenu, sDevice, FALSE) ;
               sDevice = COMMANDMSG(&msg)->cmd ;
               WinCheckMenuItem (hwndMenu, sDevice, TRUE) ;

               if (lFonts > 0)
                    {
                    free (pfm1) ;
                    free (pfm2) ;
                    }

               switch (COMMANDMSG(&msg)->cmd)
                    {
                    case IDM_SCREEN:
                         hps = WinGetPS (hwnd) ;
                         lFonts = GetAllFonts (hps, & pfm1, & pfm2) ;
                         WinReleasePS (hps) ;
                         break ;

                    case IDM_PRINTER:
                         hdcPrinter = OpenDefaultPrinterDC (hab) ;
                         hpsPrinter = CreatePrinterPS (hab, hdcPrinter) ;

                         lFonts = GetAllFonts (hpsPrinter, & pfm1, & pfm2) ;

                         GpiDestroyPS (hpsPrinter) ;
                         DevCloseDC (hdcPrinter) ;
                         break ;
                    }

               WinSendMsg (hwndScroll, SBM_SETSCROLLBAR,
                           MPFROM2SHORT (lFont = 0, 0),
                           MPFROM2SHORT (0, lFonts - 1)) ;

               if (lFonts > 0)
                    SetDataInWindow (hwndEdit, pfm1, pfm2) ;

               return 0 ;

          case WM_HSCROLL:
                         // Display different font in MLE control

               switch (SHORT2FROMMP (mp2))
                    {
                    case SB_LINELEFT:   lFont -= 1 ;  break ;
                    case SB_PAGELEFT:   lFont -= 8 ;  break ;
                    case SB_LINERIGHT:  lFont += 1 ;  break ;
                    case SB_PAGERIGHT:  lFont += 8 ;  break ;

                    case SB_SLIDERPOSITION:
                         lFont = SHORT1FROMMP (mp2) ;
                         break ;

                    default:
                         return 0 ;
                    }

               lFont = max (0, min (lFont, lFonts - 1)) ;
               WinSendMsg (hwndScroll, SBM_SETPOS, MPFROMSHORT (lFont), NULL) ;

               if (lFonts > 0)
                    SetDataInWindow (hwndEdit, pfm1 + lFont, pfm2 + lFont) ;

               return 0 ;

          case WM_CHAR:
               switch (CHARMSG(&msg)->vkey)
                    {
                    case VK_LEFT:
                    case VK_RIGHT:
                         return WinSendMsg (hwndScroll, msg, mp1, mp2) ;

                    case VK_UP:
                    case VK_DOWN:
                    case VK_PAGEUP:
                    case VK_PAGEDOWN:
                         return WinSendMsg (hwndEdit, msg, mp1, mp2) ;
                    }

               return 0 ;

          case WM_DESTROY:
               if (lFonts > 0)
                    {
                    free (pfm1) ;
                    free (pfm2) ;
                    }

               WinSendMsg (hwndEdit, MLM_SETFONT, NULL, NULL) ;
               return 0 ;
          }
     return WinDefWindowProc (hwnd, msg, mp1, mp2) ;
     }
```

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uses GpiLoadPublicFonts to load these fonts.) To access fonts that your application privately loads for its own purpose using GpiLoadFonts, use the flag QF_PRIVATE. You must use either the QF_PUBLIC or QF_PRIVATE flag, or both combined with the bitwise OR operator. Otherwise you won't get any fonts.

You can also use the two flags QF_NO_DEVICE and QF_NO_GENERIC, which refer to device fonts and generic fonts. A device font is one that is built into the graphics output device, such as those built into your printer. There are no device fonts for video displays but, for purposes of this function call, the default System Proportional font is considered to be a device font.

The generic fonts for the video display are the bitmap fonts (other than the System Proportional font) and the Adobe Type 1 fonts supported by the Adobe Type Manager. For a printer, generic fonts are the Type 1 fonts supported by ATM and perhaps—for some dot matrix printers—some additional bitmap fonts. Don't use both the QF_NO_DEVICE and QF_NO_GENERIC flags, or you won't get any fonts at all.

The third parameter to GpiQueryFonts is normally set to NULL to enumerate fonts with all face names, but you can set it to indicate a specific face name such as Tms Rmn or Helvetica. This facility was more useful back in the days when programs dealt mostly with bitmap fonts. For example, by specifying Tms Rmn a program could obtain all the sizes of Tms Rmn fonts available. It's much less useful, however, with outline fonts or device fonts. If you specify Helvetica, you'll get only one font. As you'll recall from the last column, the bold, italic, and bold italic versions of the Helvetica font have different face names.

The second to last parameter is normally the size of a single FONTMETRICS structure, but it can be set to a smaller size if you are interested only in some of the fields in the beginning of the structure but not the later fields.

Now you can see why I began with the example rather than the general syntax! For 95 percent of the times you use GpiQueryFonts, your code will look almost exactly as shown in the example.

DISPLAYING THE STRUCTURE Now that we know how to enumerate fonts, let's do so. We'll use the FONTLIST program shown in Figures 1 through 5. If you have the IBM C Developer's WorkSet/2 installed, you can create FONTLIST.EXE by executing:

```
NMAKE FONTLIST.MAK
```

on an OS/2 command line. Or you can download the source code and executable from the Programming Forum on PC MagNet, archived as FONTLI.ZIP.

The program contains a single drop-down menu labeled Device that you can use to select either the video display or the default printer. As you can see in Figure 6, the fields of the FONTMETRICS structure are displayed in the window. The vertical scroll bar at the right lets you scroll through the structure fields for a particular font. The horizontal scroll bar on the bottom lets you page through all the available fonts.

You'll notice that some of the structure fields are displayed with two numeric values. These are the FONTMETRICS fields that return information in world coordinates, accepted by virtually all drawing functions supported by GPI. World coordinates are mapped to device coordinates (pixels) through a series of transforms, allowing a program to specify coordinates in units of inches or millimeters or anything else. Accordingly, some functions such as GpiQueryFonts return information in world coordinates. The first number in these fields is the value in pixels; the second is the value in decipoints, which is $\frac{1}{10}$ of a point or $\frac{1}{720}$ of an inch.

A FONTLIST OVERVIEW It's been a while since we've tackled a Presentation Manager program in this column, so let's review some basics. Unlike Windows—but like normal C programs—Presentation Manager programs have a main function that is the entry point to the program. The main function usually takes care of initialization by creating a message queue, registering a window class, and creating a standard window—in this case one that contains a title bar, a menu, a system menu, a sizing border, a horizontal scroll bar, and minimize and maximize buttons.

The program then enters a message loop to retrieve messages for the win-

FONTLIST.MAK
Complete Listing

```
#-------------------------
# FONTLIST.MAK make file
#-------------------------

fontlist.exe : fontlist.obj fontlist.def fontlist.res
     link386 /BASE:0x10000 fontlist,, NUL,, fontlist
     rc fontlist.res

fontlist.obj : fontlist.c fontlist.h
     icc -C -Kbcpr -Ss fontlist.c

fontlist.res : fontlist.rc fontlist.h
     rc -r fontlist.rc
```

Figure 2: **This is the make-file for the FONTLIST program.**

FONTLIST.RC
Complete Listing

```
/*---------------------------------
   FONTLIST.RC resource script file
  ---------------------------------*/
#include <os2.h>
#include "fontlist.h"
MENU ID_RESOURCE
     {
     SUBMENU "~Device",        IDM_DEVICE
          {
          MENUITEM "~Screen",       IDM_SCREEN,, MIA_CHECKED
          MENUITEM "~Printer",      IDM_PRINTER
          }
     }
```

Figure 3: **This resource script defines FONTLIST's menu.**

FONTLIST.H
Complete Listing

```
/*-----------------------
   FONTLIST.H header file
  -----------------------*/

#define ID_RESOURCE       1

#define IDM_DEVICE       10
#define IDM_SCREEN       11
#define IDM_PRINTER      12
```

Figure 4: **The header file defines constants used in both the source code and resource script.**

dows in the program. On exit from the message loop (caused by a quit message), the program destroys the window and the message queue, and then terminates. The ClientWndProc window procedure (toward the end of FONTLIST.C) processes all messages to the client window. The first message is WM_CREATE.

To simplify the display of the FONTMETRICS information, I decided to overlay the client area with a read-only multiline edit (MLE) control with a vertical scroll bar. This MLE control is created during ClientWndProc's WM_CREATE message and resized during the WM_SIZE message. (As I'll discuss later, using an MLE control turned out to be not the best solution!)

After creating the edit control, ClientWndProc obtains a presentation space for the window by calling WinGetPS and then calls GetAllFonts. This function enumerates the fonts, storing them in arrays of FONTMETRICS structures. Two arrays are required for showing some fields in units of both pixels and decipoints.

By default, world coordinates for a presentation space obtained using WinGetPS simply map to pixels. Thus, when GetAllFonts calls GpiQueryFonts to obtain an array of FONTMETRICS structures, the fields that contain values in world coordinates are in units of pixels.

Next, the GetAllFonts function sets world coordinates to decipoints by altering the device transform. The device transform is one of several transforms under GPI. Conceptually, the device transform maps the four corners of a rectangle known as the *presentation page* to the four corners of a rectangle known as the *page viewport*. The page viewport rectangle is in units of pixels, and by default is the size of the output device. For example, the default page viewport for the VGA is 640 pixels by 480.

By setting the presentation page to the size of the output device in decipoints, the device transform allows you to specify world coordinates in decipoints. You can use GpiSetPS to alter the size of the presentation page.

To obtain the information necessary to set the presentation page size, you use DevQueryCaps. The CAPS_WIDTH parameter to DevQueryCaps obtains the width of the output device in pixels; for example, 640 for the VGA. The CAPS_HORIZONTAL_FONT_RES parameter obtains the font resolution of the device; for instance, 96 for the VGA. Dividing 96 into 640 gives the width of the display in inches. Multiplying by 720 yields the width in decipoints. Thus, this must be the width of the presentation page.

After setting a new presentation page size, GetAllFonts calls GpiQueryFonts again to obtain a FONTMETRICS structure with fields in units of decipoints.

When you use the menu to switch from the video display to the default printer (or back), ClientWndProc gets a WM_COMMAND message. For the printer, it uses the CreatePrinterPS and OpenDefaultPrinterDC functions to obtain a presentation space for a printer device context, and calls GetAllFonts again.

DEALING WITH THE MLE I wanted to avoid the messy logic required to display the FONTMETRICS information and manage the vertical scroll bar, so I figured it would be easier to format all the data as a single character string and let a multiline edit control handle it. The MLE solution let me avoid some problems, but it created others.

First, to get all the information to line up nicely, I had to force the MLE to use a fixed-pitch font. This required setting up an FATTRS structure and passing it to the MLE via an MLM_SETFONT message. ClientWndProc does this during the WM_CREATE message using the information obtained from GpiQueryFonts. Of course, we haven't learned about the FATTRS structure yet, so this seems a little premature.

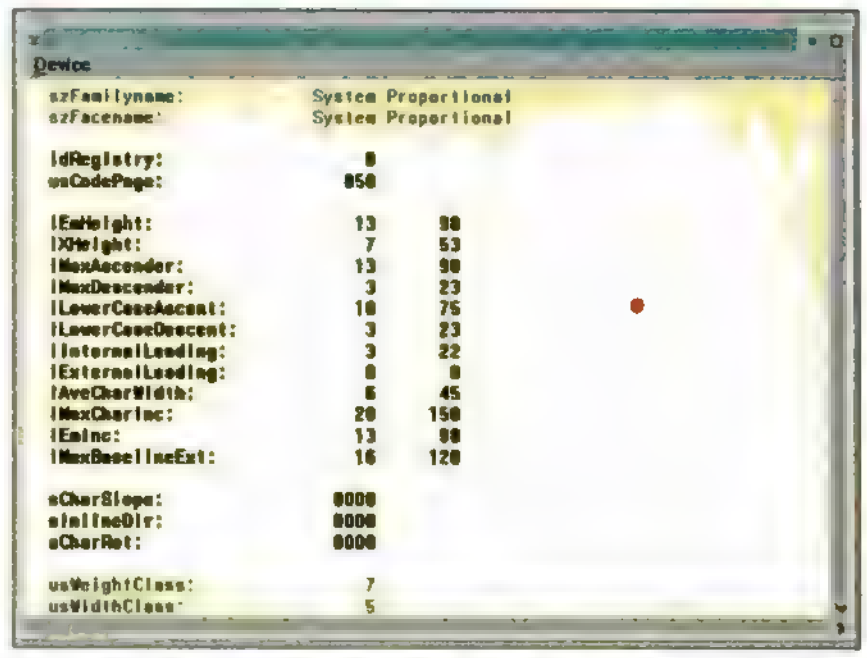

Figure 6: **This shows the FONTLIST program running on a VGA display under the OS/2 2.0 Presentation Manager.**

To display the information in the MLE window, the FormatData function puts it all in a large character string, and the SetDataInWindow function calls WinSetWindowText to set the string as the MLE contents.

Another problem I encountered with the MLE related to input focus. When created, the MLE doesn't have the input focus; the client window does. Thus, to provide a keyboard interface for the vertical scroll bar, ClientWndProc must trap some WM_CHAR messages for up and down cursor keys and send them to the MLE control. The left and right cursor keys are sent to the horizontal scroll bar. If you press the down-arrow key, you might expect the contents to the MLE to scroll by one line. But it doesn't. The MLE maintains its own internal cursor, initially set to the top line. You can't see it because the MLE doesn't have the input focus. So, pressing the down-arrow key just moves the MLE cursor down a line. Not until it reaches the bottom of the window will the MLE contents scroll.

If you happen to click on the MLE window, it then gets the input focus. You can see the cursor, even block out areas of text and copy them to the clipboard. But then you don't have a keyboard interface for the horizontal scroll bar!

Oh, well. Using a multiline edit control was an interesting idea, but I think in the future I'll bite the bullet and code my own display and scroll bar logic.

In the next column we'll begin exploring the fields of the FONTMETRICS structure. □

FONTLIST.DEF

Complete Listing

```
;------------------------------------
; FONTLIST.DEF module definition file
;------------------------------------

NAME           FONTLIST  WINDOWAPI

DESCRIPTION    'Font Lister for OS/2 2.0 PM
(c) Charles Petzold, 1992'
PROTMODE
```

Figure 5: **Here is FONTLIST's module definition file.**

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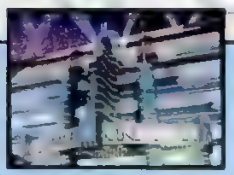

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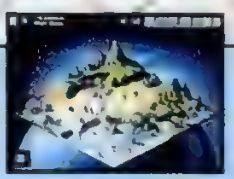

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Corel Draw Vers Upgrd	145	NA
Corel Draw Comp Upgrd	235	NA
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Kings Quest V		
Loom		
Mavis Be		
Micros		
Mic		
M		

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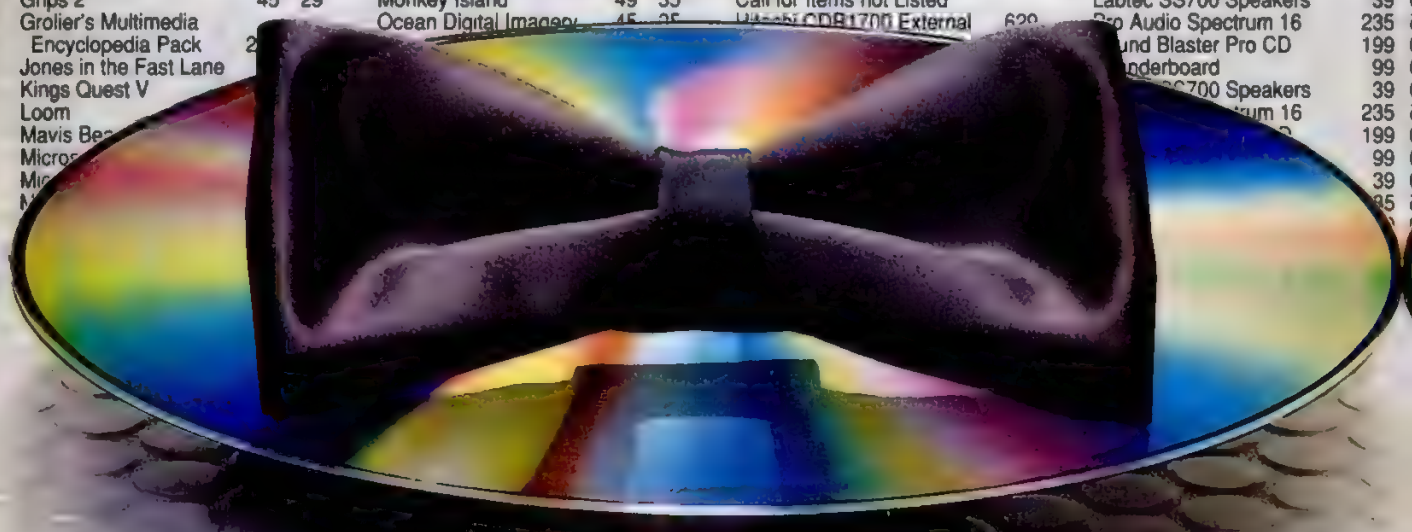

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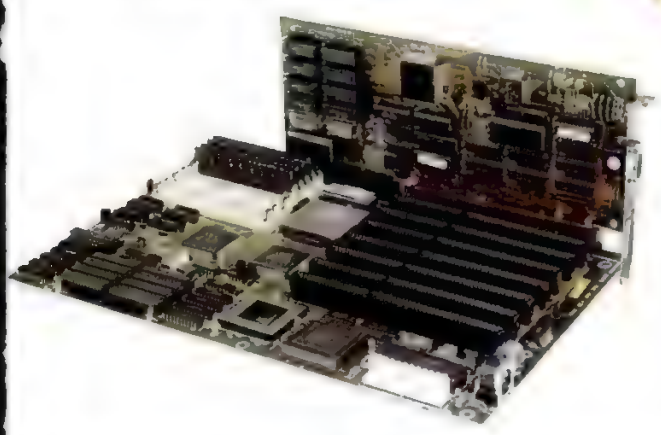

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   2. Arrow pointing to the fold
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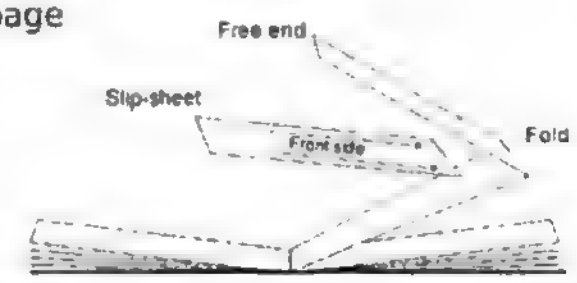
4. Close the page and slip-sheet



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1. Open the foldout page
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-Computer Shopper 1/92

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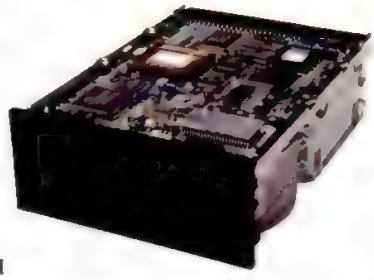

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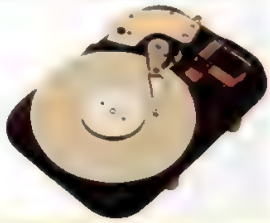

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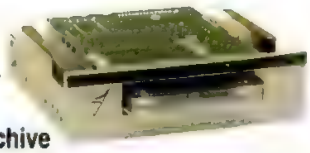

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Solutions

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PCs

SOLVING MEMORY PARITY ERRORS

❓ Lately my system seems to be possessed by demons. It randomly locks up or crashes and reboots for no apparent reason. While loading or running Windows 3.1, I often get the message, "System error. Memory parity error detected. System halted." I then have to do a cold boot or hit the reset switch. After rebooting, the system may run for a few hours and then crash again. Twice while running DOS applications, the system crashed, displaying the message, "RAM parity error." Occasionally the system just reboots on its own. What's wrong?

Jeffrey Karasik
Monticello, New York

▶**PC MAGAZINE** It sounds as if the problem is originating in your system's memory. There are nine chips in each bank of system memory. The first eight chips act as storage for a byte (one bit per chip). The ninth is the parity chip, a memory diagnostic feature used in PCs.

When the microprocessor writes a byte of data to memory, it stores the byte as 8 bits (each having a value of either 0 or 1) and appends a parity bit. If the value of bits in the 8-bit pattern is odd, the parity bit is set to 1; if the value is even, the parity bit is set to 0. Hence, the sum of all the bits, including the parity bit, must be even.

When the microprocessor reads from memory, it also appends a parity bit. If an odd value is detected, the system knows something is wrong and generates a parity error. Unfortunately, that is about all it knows; the parity bit itself could even be causing all the trouble.

Interaction between expansion cards can also cause such problems. If your demons appeared right after you installed a new card, try taking it out and see if the problem clears up. Let's assume that the system hasn't been changed and the problem appeared on its own.

The first step is to make sure all your memory chips are well seated in their sockets. DIP (dual in-line package) memory chips have a habit of loosening up as a result of the repeated heating and cooling cycles while your computer is turned on and off. Press down firmly on the DIP chips to reseat them.

If the problem persists, you may be able to solve it by replacing your memory chips with those from another system. Make sure that you replace only one chip at a time and that you use chips with the same capacity (measured in kilobits or megabits) and speed (measured in nanoseconds) as the original. This method can take a long time, especially with an intermittent error like this one, and it will work only if there is just one bad component. (The process is a lot like trying to find the burned-out bulb in a string of Christmas-tree lights.)

Diagnostic programs that exercise the individual memory locations and then report the approximate physical location (that is, which chip in which memory bank) of the memory problem may also be helpful. CheckIt LAN from TouchStone Software Corp. (800-531-0450) and QAPlus from DiagSoft (408-438-8247) both include this feature. On the other hand, it may be easier to just get rid of that old memory and use this as an excuse to move up to higher-capacity chips. Haven't you been looking for a reason to move up to 8MB or more?

—Alfred Poor

Our Advisors

Douglas Boling is a contributing editor and the author of many utilities, including MBOOT.COM and EMS40.SYS.

Frank J. Derfler, Jr., is senior networking editor and the author of the *PC Magazine Guide to Connectivity.*

Alfred Poor is a contributing editor and the author of the *Hewlett-Packard LaserJet Printer Handbook.*

Jeff Prosise is a contributing editor and the author of the *PC Magazine Guide to DOS 5 Memory Management.*

Sal Ricciardi is a contributing editor and the author of the forthcoming *Running FoxPro* books from Microsoft Press.

Neil J. Rubenking is technical editor and the author of two Turbo Pascal books and *PC Magazine DOS Batch File Lab Notes.*

Joe Salemi is a contributing editor and the author of the *PC Magazine Guide to Client/Server Databases.*

Luisa Simone is a contributing editor and the author of *Microsoft Publisher.*

Craig Stinson is a contributing editor and coauthor of *Running Windows 3.1* and *Running Microsoft Excel.*

M. David Stone is a contributing editor and coauthor of *Word for Windows Companion,* 2nd Edition.

Ethan Winer is a contributing editor and the author of *PC Magazine BASIC Techniques and Utilities.*

Peripherals

PUTTING YOUR SYSTEM ON STANDBY

❓ I'm planning to buy a standby power supply for my computer system. How do I determine how many watts I need?

Dennis Winter
Los Gatos, California

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▶PC MAGAZINE A standby power supply is an important addition to any computer system. This type of device contains batteries that provide power to your system almost instantly if your electricity goes out. Without this protection, you risk losing valuable data.

The first step is to take inventory of the items you'd like to protect. Keep in mind that you shouldn't put all your equipment on the standby unit, only whatever is critical to system operation. For example, there's usually no need to include your printer, since you can abort a print job and shut down your system when the power goes out; your only losses will be some time and paper. Remember that some peripherals tend to draw a lot of power.

Next, you must determine the amount of power each item on the standby unit draws. Most standby power supplies are rated in terms of watts, while computer equipment is usually rated in amps or milliamps (mA). (You can usually find the number of amps a piece of equipment requires on the information plate on the back of the item or in the owner's manual.) So to figure out what size unit you'll need, multiply the voltage by the number of amps. American electricity usually ranges between 110 and 120 volts, so we'll use 115 as a happy medium.

Thus, for a typical monitor rated at 1.4 amps, multiply 1.4 amps by 115 volts, for a power requirement of 161 watts. A desktop computer rated at 3 amps would require 345 watts. (Items rated in milliamps can probably be disregarded since they will add a negligible load compared with larger items. But if you want to check anyway, multiply the volts by the number of milliamps and divide by 1,000.) Equipment with motors and heating elements (a laser printer, for example) can go right off the scale. An HP LaserJet II is rated at a whopping 7.6 amps, so it would need an 874-watt standby power supply—higher than most units are rated. These are maximum demand estimates; most of the time, your computer and components won't draw the full current. But at times of peak demand (during power-up, for example), you will be drawing close to the full amount and therefore must plan for the maximum.

Finally, add up all the watt ratings for your components, and you'll have the minimum-size standby power supply for your system. Remember that the life span of a power supply's battery depends on the load, so a unit with a higher rating than you need will keep things running longer when the power goes out.

Some backup power units can condition the incoming power to prevent physical damage from voltages that are too high or too low. While this may sound like a good reason to put all your equipment on the standby unit, it isn't—for two reasons. First, while your laser printer can be damaged by a power surge, in most cases the cost of protection exceeds the price of repairing the damage. Second, you can buy a power conditioner without a battery backup. These units are much cheaper and are therefore a better bet if you want to protect a power-hungry device like a printer.

If you're planning to buy more than one standby unit for a group of computers, consider getting one large unit and wiring it to a dedicated outlet for each computer. One 1,200-watt unit typically costs less and takes up less space than three 400-watt units, and you often get added protection from larger units, such as regulated voltage during brownouts.

The trick in selecting a standby power supply is to match your system's needs with a unit. If a unit is too small, it won't be able to handle the demand, and you'll trip its circuit breaker. Overestimate your needs, however, and you'll spend more than you have to.—*Alfred Poor*

HOW TO CONTACT US

Do you have a hardware, software, or systems problem you can't solve? Do you have a tip you think other readers could use? Or maybe you'd like a better understanding of how something works. If so, we invite you to let us know about it. Our experts can give you practical solutions to your problems, provide techniques for using your software and hardware more productively, and help you grasp computer concepts and understand the latest technology.

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For any tip we print, you'll receive $50 plus a *PC Magazine* T-shirt.

Operating Environments

MANAGING WINDOWS SCREENSHOTS

TIP I constantly need to capture Windows screens, icons, dialog boxes, and so forth, for use in computer manuals. But including such images in my Word for Windows documents made the documents almost unmanageable (one is 15MB!). And the gray bitmapped buttons and bars that many applications display are almost unreadable after my HP LaserJet III printout is photocopied.

The solution to both problems was to exit Windows, go into Setup, and choose the VGA with Monochrome display driver. Not only are the screenshots much improved, they're one-eighth the size! I hope others find this of value.

Helen Herriott
Victoria, B.C., Canada

Powerstrokes:

Morning practice for the Head of the Charles Regatta, Boston

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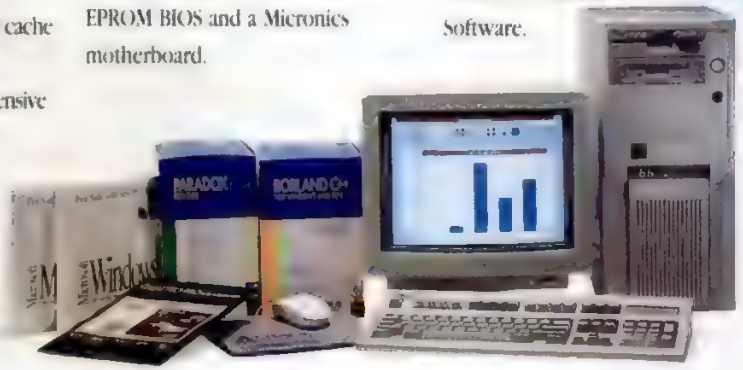

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Storing a Full-Screen Image

Bits per pixel	1	4	8	15	24
Colors	2 (mono)	16	256	32,768	16,777,216
640 x 480	38K	150K	300K	600K	900K
800 x 600	59K	234K	469K	938K	1,406K
1,024 x 768	96K	384K	768K	1,536K	2,304K
1,280 x 1,024	160K	640K	1,280K	2,560K	3,840K

Figure 1: **This table lists the number of bytes required to store a bitmap containing the full screen using different combinations of screen size and bits per pixel.**

▶PC MAGAZINE The amount of disk space required to store a noncompressed Windows bitmap depends on the dimensions of the bitmap *and* on the number of bits needed to store each pixel. The number of different colors that can be displayed on-screen at once depends on how many bits are used per pixel; each added bit doubles the number.

Figure 1 shows the number of bytes required to store a full screen using different combinations of screen size and bits per pixel. Note the six shaded boxes in the table; they represent combinations of screen size and bits per pixel that require more than 1MB of video memory.

Switching to the VGA monochrome display driver reduces the number of bits per pixel to the absolute minimum. In this mode, each pixel is represented by a single bit. If that bit is 1, the pixel is white; if the bit is 0, then the pixel is black. For screenshots that are going to be printed strictly in black and white, minimizing the size by using the monochrome display driver would make sense.

Do note, however, that most programs look rather different when running under the monochrome display driver. There are no grays; everything is either black or white. Also, the shape of some Windows controls may be different. For example, the formatting buttons on the WinWord screen are taller and narrower in monochrome mode. If this isn't acceptable for your screenshots, choose the plain 16-color VGA driver. Don't use a driver with more than 16 colors or a screen resolution above 640-by-480 unless you absolutely must!

—Neil J. Rubenking

Word Processing

LEANER WORDPERFECT FILES

TIP WordPerfect will often create files that are far larger than the amount of text in the file would seem to justify. If you've changed fonts in a document, a lot of this excess size comes from unnecessary font information remaining in the file.

Fortunately, there is a simple way to remove the superfluous information from a document and reduce file size. Start with an empty document screen, enter a single space, and use the List (F5) or Retrieve (F10) command to load the file you want to slim down. When you specify the file and give the command to retrieve it, WordPerfect will prompt with the question, "Retrieve into current document?" Answer yes, and WordPerfect will load the file into the current document window.

If you then save the file under its original name or any new name, you'll find that it will often be dramatically smaller than the file you started with. More importantly, the file will retain the smaller size unless you change fonts again. And if you change fonts, you can slim the file down again by following the same procedure.

Martin W. Schwartz
Yonkers, New York

▶PC MAGAZINE For anyone who uses more than one font in WordPerfect, this tip is worth keeping in mind. To take best advantage of it, however, you have to delve a little deeper into what WordPerfect is doing and why this works.

Every WordPerfect-format document file starts with a header, or prefix, that stores information about that file. This information includes (but is not limited to) the document summary, document printer, a list of fonts used in the document, and proportional-space tables for any proportionally spaced fonts in that list.

Each time you add a new font code to the document (using the Ctrl-F8, Base Font command), WordPerfect adds the appropriate information for that font to the document prefix. The same thing happens for certain other font codes relating to size and appearance.

The number of bytes added for each font will vary, depending on such issues as the document printer, the font size, and the number of characters included in the font. At one extreme, if you're using a dot matrix printer with monospaced fonts, adding a new font may add less than 100 bytes. At the other extreme, with scalable fonts, each new code could add 2,000 to 3,000 bytes.

DESQVIEW/TURBO PASCAL CONFLICT

▶PC MAGAZINE If you use the Turbo Pascal Integrated Development Environment (IDE) under DESQview, you're likely to experience a conflict. The Ctrl-Break key is used in the TP IDE to break out of a program that's in an endless loop. But if you press Ctrl-Break while running TP under DESQview, you can lock up the whole system. You could just press Ctrl-Alt-Del to close the DESQview window containing TP, but that, of course, wipes out any unsaved data in open files. What a dilemma!

Fortunately, there's a solution. Bring up the main DESQview menu, press O for Open, and type CP for Change Program. Type the two-letter code you've assigned to Turbo Pascal, and you'll see the Change Program dialog box. Press F1 to switch to the advanced options dialog and look for the label Keyboard conflict (0-F). Tab down to the box associated with this label, enter the number 8, and hit Enter to save the change. Now you can safely press Ctrl-Break while running TP under DESQview!

If your screen shows the label Keyboard conflict (0-3), or if DESQview refuses to accept 8 as a Keyboard conflict value, you need to upgrade to the current version of DESQview.

—Neil J. Rubenking

Figure 2: **If you clear out unused font codes by searching for them and replacing unwanted codes with nothing, be careful when giving permission to replace. In this example, WordPerfect has found the font code for Dutch 801 Bold 12pt and is waiting for confirmation to replace it—or effectively delete it. However, the program has highlighted the code immediately following. If you answer yes here, WordPerfect will keep the highlighted Swiss 721 Bold 12pt code and delete the Dutch 801 Bold 12pt code.**

Unfortunately, WordPerfect's automatic updating of font information works only in one direction: to add information. If you delete a font from a document, substituting, say, Times Roman 12-point for Times Roman 10-point, WordPerfect does not delete anything from the header. The extra information merely takes up space, making the file larger than it has to be.

If you then retrieve the file into a new document, WordPerfect strips out the old information, basing the new prefix on only those font codes that are still in the document text. In the example, the new prefix would not include the font information for Times Roman 10-point and would therefore be smaller.

Note that the font information in the new prefix is based on the *codes* in the file, not on the fonts that you're using. This is a subtle but important difference. If you change fonts by inserting a new code (by using the Ctrl-F8, Base Font command and then choosing a font) without deleting the old code, the old code will still be in the file, even though it is not applied to any text. Because the old code is in the file, WordPerfect will store the font information in the file prefix.

For this reason, before you shrink a file by retrieving it into another document, you should first delete any font codes you're not using. The easiest way is to delete them when you enter new codes. Use Alt-F3 (Reveal Codes) to split the screen so you can see the codes and then delete the unwanted codes either before or after you insert the new ones.

If you don't delete the old codes as a matter of course when you insert new ones, you can find and delete them either by scanning the screen visually with the Reveal Codes screen showing or by using the Search (F2) or Replace (Alt-F2) command.

In most cases, the Replace command will be the preferred choice. With the cursor at the start of the document and the Reveal Codes screen showing, press Alt-F2, answer yes to the `w/Confirm` prompt, then respond to the `Srch` prompt with Ctrl-F8, Base Font. This will show onscreen as `[Font]`. Next, hit F2 to complete the entry, making sure there is nothing entered in response to the `Replace with` prompt, and hit F2 again to complete the Replace entry.

You can then use the replace feature as usual, answering yes to delete the unwanted font codes and no to leave other codes untouched. But be careful when giving permission to delete a code. When WordPerfect finds a match, it highlights the character just after the match it has stopped at and asks for permission to replace, as shown in Figure 2. If you have two codes next to each other, WordPerfect will find the first code and highlight the second code. The code that will be deleted is always the one before the cursor highlight, *not* the highlighted code.

One other important issue is that file size is affected by WordPerfect's Fast Save feature, which you can turn on or off by choosing Shift-F1, Environment, Fast Save (Shift-F1, Fast Save in Version 5.0) and then choosing yes or no.

With Fast Save off (set to no), WordPerfect cleans some information out of the prefix each time you save. For example, if you've changed printers, the program will delete the reference to the old printer. With Fast Save on (set to yes), WordPerfect speeds the save by doing less housekeeping. Rather than updating the printer information, for example, it writes a second copy of that information, whether it's been changed or not, and it marks the first copy as superseded.

According to the manual, the superseded information is purged the next time you load the file from disk (or save with Fast Save off). However, my tests show—and a WordPerfect representative confirmed—that the program keeps two generations of the duplicated information—no matter how many times you save the file or load it from disk. In any case, the additional information in the header means you get a larger file with Fast Save on than with Fast Save off.

Finally, saving disk space is an important enough consideration that it's well worth automating this basic technique. Figure 3 shows a WordPerfect 5.1 macro that will save the current file, retrieve it into a new document, and then save the new document under the original filename. (You can download SLIMIT .WPM from the Utilities/Tips Forum on PC MagNet.) Because you're unlikely to need this technique until after you've saved the document at least once and re-edited it to change fonts, the macro assumes that the document already exists as a file on-disk. If it doesn't, simply save

SLIMIT.WPM

Complete Listing

```
(;)Get·file·path·and·name~
{ASSIGN}FName~{SYSTEM}Path~{SYSTEM}Name~~
(;)Save·file·under·current·name·and·clear·document·window~
{Exit}y{Enter}yn
(;)Enter·one·space,·retrieve·file·into·window,·delete·space,·and·save~
·{Retrieve}{VARIABLE}FName~{Enter}
{Backspace}
{Save}{VARIABLE}FName~{Enter}y
```

Figure 3: **This simple macro, SLIMIT, first looks for the path and name of the current document file and then saves the file. It then enters a single space in an empty document window and retrieves the file into the new document, eliminating excess information from the file prefix in the process. Finally, it saves the new, slimmed-down file under the original filename.**

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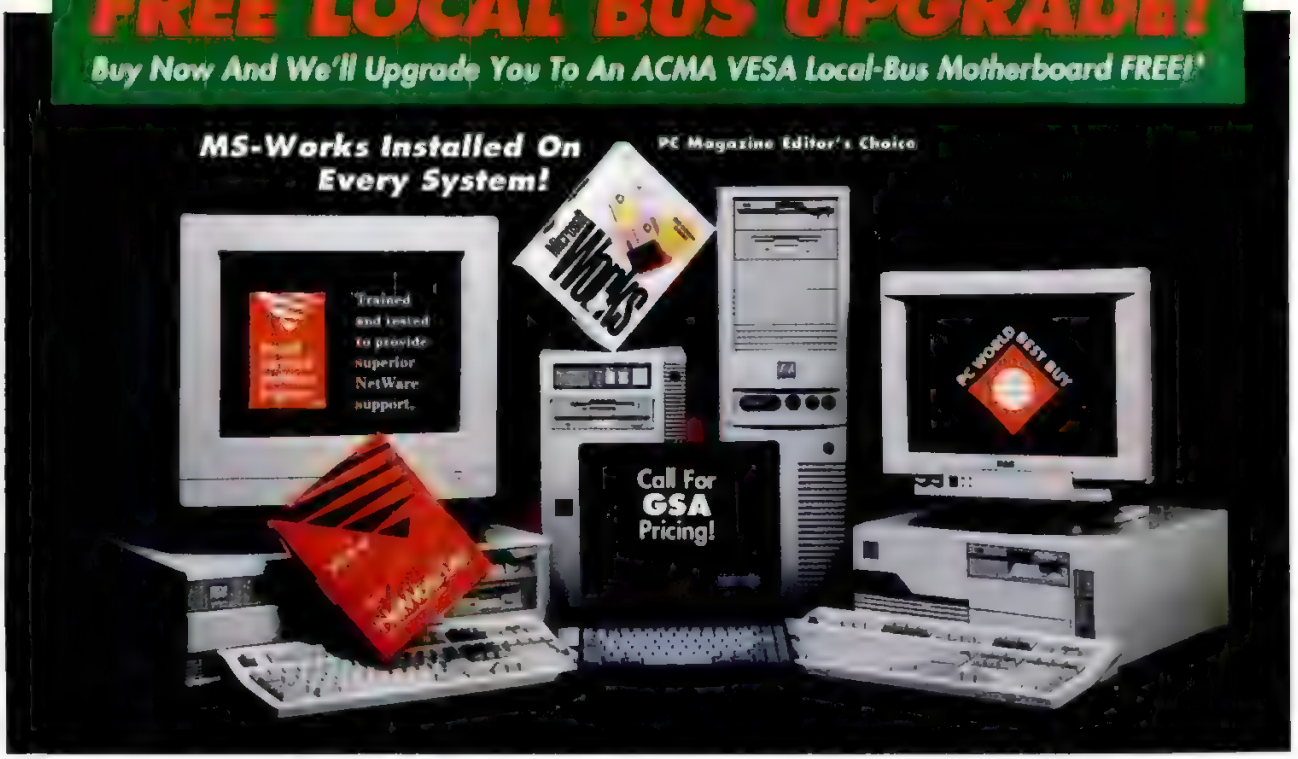

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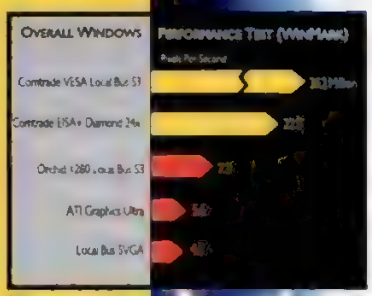

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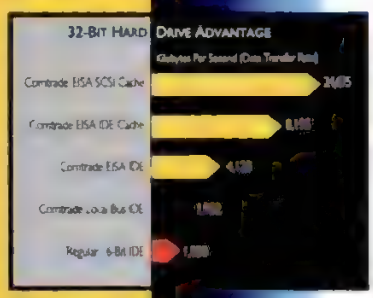

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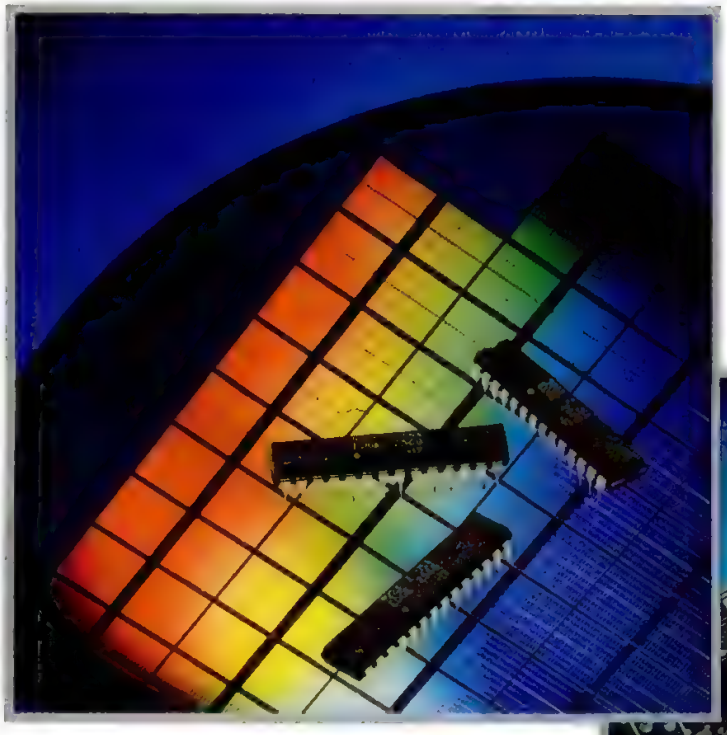

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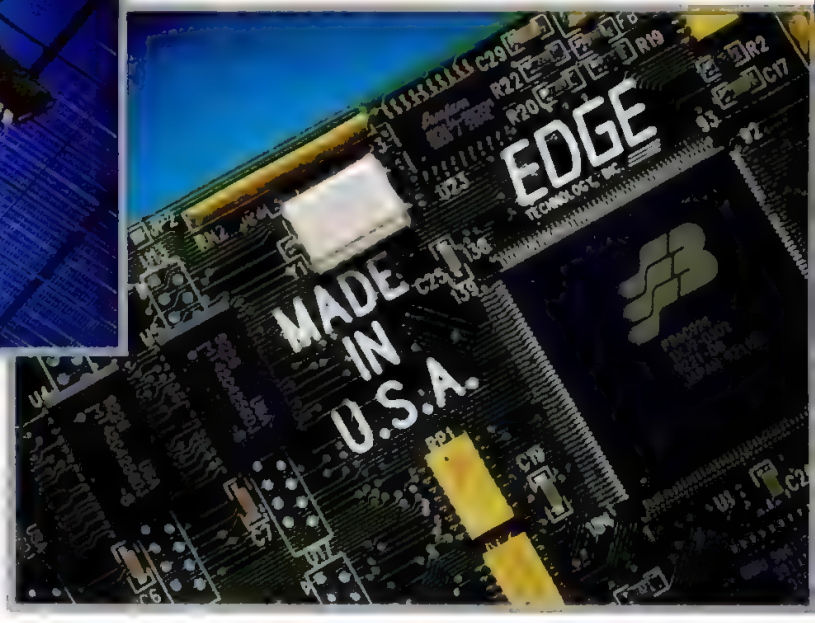

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Inside the New FastMicro 486/Pro!

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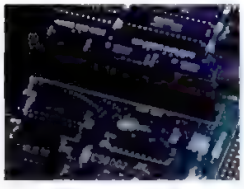

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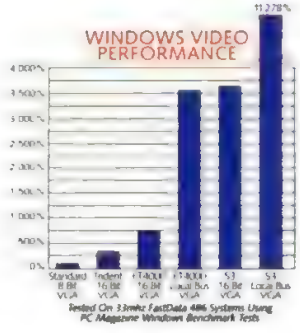

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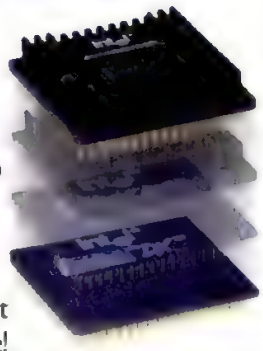
FastMicro Maximizes Performance

Advanced Upgrade Path!



Not only do you get a high performance 486 PC today, but you can upgrade it tomorrow! Put a 33MHz FastMicro 486/Pro system on your desk and when you're ready for even more power, you can pop in an Intel OverDrive™ processor and boost performance even more!

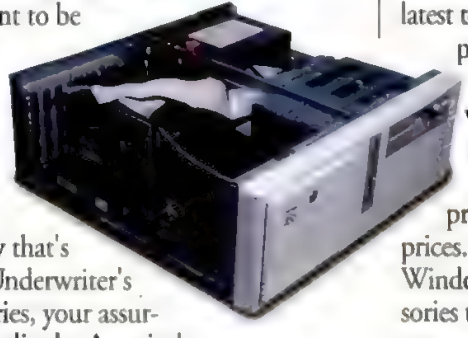
Your 486/Pro system is compatible with Intel's fastest processors so you're assured of state of the art performance now and a growth path tomorrow!

Dual Intelligent Cooling Fans: Only from FastMicro!

Every desktop FastMicro PC comes with dual cooling fans. It has a main fan that's quieter than fans in ordinary PCs - plus it includes a special second fan that comes on only when the system gets warm. A cooler system lasts much longer - a concern particularly when upgrading to higher heat-producing clock doubler chips.

Fourth Generation Case

Our desktop case is uniquely engineered to provide the highest quality and maximum expandability in a space saving design. It has a total of seven drive bays to accommodate all of the storage options our customers tell us they want to be able to add in the future. It also has extra protection against electrical interference, unlike the weaker systems others sell. It also includes a power supply that's listed by Underwriter's Laboratories, your assurance of quality by America's most prestigious safety organization.

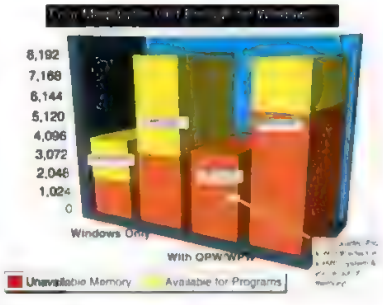


Conner 212Mb Higher Performance Drive.

FastMicro ups the ante with Conner's CP-30204 212mb IDE hard drive standard in 486/Pro systems. Conner has a reputation for building the most reliable drives on the market. Couple this with a 12 millisecond access time and up to 8MB/sec. data transfer rate and you won't want to gamble on a less reputable drive. No wonder Conner is now the #1 manufacturer of hard disks in the world!

Eight Megabytes of Memory!

Running Windows? Don't run out of memory! When Windows runs low on memory, it starts using your hard drive like memory. Memory is 200+ times faster than a hard drive - don't get caught short! FastMicro includes a full eight megabytes of RAM in every 486/Pro system.



Start with FastMicro, Stay with FastMicro.

Why call one company to order your PC and another for everything else? FastMicro is the only leading system vendor that also advertises a full line of software, peripherals and more to complete your system and keep you abreast of all the latest technology products to maximize your computing productivity.

Four times a year, we'll send you our informative catalog featuring over five hundred PC products at low FastMicro prices. It features everything from Windows software to books, accessories to networking, and printers to games. FastMicro is truly your one-stop shop!

FastMicro 486/Pro Series - Don't Settle for Less!

4DX/33 $1999

4DX2/66 $2399

- i486™ Processor with 8K Internal Cache.
- High Speed 128K External Static RAM Write-Back Cache.
- Upgradable to Overdrive Processors.
- 8 megabytes of high speed RAM.
- 212mb 12ms Conner IDE hard disk.
- 1.2mb 5.25" & 1.44mb 3.5" Toshiba floppy drives.
- VESA Local Bus SVGA Windows Accelerator Card with 16.7 Million Colors Maximum.
- VESA Standard Non-Interlaced 14" Super VGA color monitor with 800x600 @ 72hz & 1024x768 @ 70hz and Edge-To-Edge Video.
- Dual Intelligent Cooling Fans.
- Clock calendar, parallel port, game port and two serial ports.
- 8 expansion slots, 2 occupied.
- Fourth Generation Desktop Case.
- 200 Watt UL Listed Power Supply.
- Microsoft DOS.
- Microsoft Windows 3.1
- Microsoft Serial Mouse.
- Choice of Two Major Software Applications: WordPerfect for Windows, Quattro Pro for Windows, Paradox, PC Tools and/or Graphics Works for Windows.
- FastMicro Peace of Mind.

Legendary FastMicro Service

FastMicro backs up all FastData PC's with the most comprehensive service in the business. Seven day a week toll-free technical support is included for as long as you own your FastData PC. In the unlikely event a part should fail during the one year warranty, we'll express ship you the replacement part. If we still can't resolve the problem, we'll send GE on-site or replace the system at no charge.

GE Computer Service

Satisfaction Guaranteed

We'd love to add you to the FastMicro family of satisfied customers. Every FastData 486 PC comes with our 30 day money back satisfaction guarantee.

But if you're like the majority of our customers, you'll be very satisfied. After all, at FastMicro, we want you as a customer for life - not just today.

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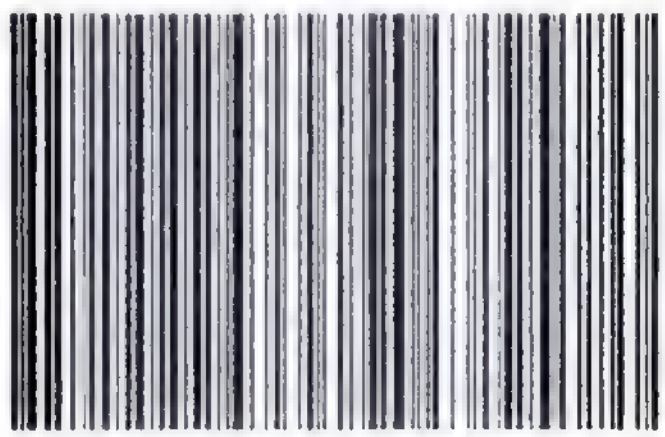
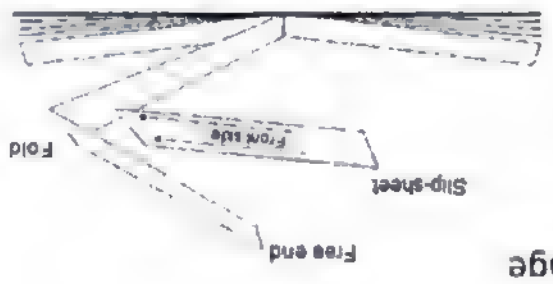
FASTMICRO 1-800-824-6000

Folded edge of the page



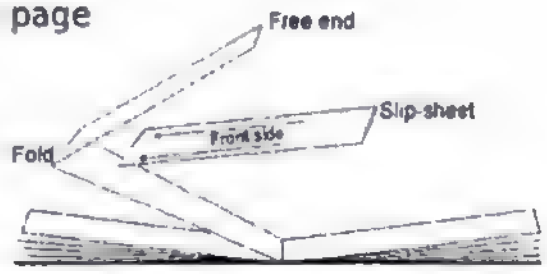
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Back

1. Follow instructions on the other side

GbsSlipBack-001B

Back

1. Follow instructions on the other side

High Performance Software Included Too!

tart with Windows & a enuine Microsoft Mouse!

With FastMicro 486/Pro systems you get more! Of urse you get the latest versions of Microsoft DOS nd Windows prein- alled. But unlike ost of our competi- rs, we include a true licrosoft mouse, not e lowest price mouse e could find.

ake Two - Get up to 700 Worth of Software

The best computer deserves the best software and stMicro includes some of today's hottest software at no tra charge! Choose any two of the following titles and u'll get the latest versions complete and ready to run. verything's included and you get full manufacturer sup- ort (unlike some other 'bundles'). The products come in ecial FastMicro boxes - retail boxes shown.

WordPerfect for Windows

WordPerfect is the #1 selling word processing software and the Windows version is loaded with features. It includes the ability to create & edit tables, equations, lists and graphics. You can even edit graphics created with other programs! Plus, it works with ur WordPerfect for DOS files and uses familiar Word- erfect commands so your transition to Windows is easy.

C Tools 8.0

The latest version of the top sell- g utility software! PC Tools 8.0 dds an all new DOS desktop with tegrated application menu & man- ger, file viewer & manager, sched- ler, and desk accessories. You also get entral Point's award-winning back- p and a hot new version of Anti- irus. PC Tools also includes DiskFix, FileFix, Undelete, nformat, Disk Edit, Defragmenter, Cache and more! entral Point Commute lets you remotely run Windows or OS applications and you get new RamBoost Memory ptimizer too!

Quattro Pro for Windows

"Quattro Pro for Windows is worth the wait" proclaims PC Magazine. QPW uses spreadsheet notebooks to easily organize your spreadsheets. Click your right mouse button and Object Inspectors lets you change attributes instantly! Speedbars give you those one-click shortcuts that change depending on what you're working on! Interface Builder lets you build applications without programming. "QPW comes with a separate Database Desktop application -a beautifully designed query-by-example tool" says PC Magazine, "QPW's graphs are gorgeous and include rotatable 3-D types as well as options to adorn them." Need we add more?

Paradox 4.0

Paradox is the most advanced relational database ever created for the PC. Now it's the fastest. For first time users or application developers, Paradox provides the ease of use and power you need! New Application Workshop, Paradox's application generator, lets you easily develop custom applications. Paradox also has automatic multiuser support and is network ready. Combine this with the full suite of development tools and SQL connectivity and Paradox is the database of choice!

Graphics Works for Windows

With five applications in one, Graphics Works from Micrografx gives you complete graphic tools for Windows. Includes Windows Draw! - the hot selling package that lets you create graphics compatible with your other Windows programs. It also includes new Photo Magic! - the photo editing software that comes with hundreds of photos you can or modify and use in you documents (plus you'll have photo realism on-screen with FastMicro's true color video). You get a charting tool and the leading organization charting software for Windows. Plus you get a bonus CD with over 1,000 photos and 10,000 pieces of clip art you can use as-is or customize with Graphics Works!

Why settle for less?
FastMicro includes the real thing: a Microsoft Mouse.

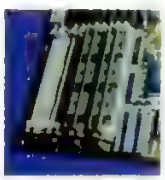
True Intel 486 for Less Than $1,000!

Introducing FastMicro's 486/Valueline.

Don't need all the extra features of our 486/Pro Series? Then the 486/Valueline is right for you. This system is truly a price breakthrough! FastMicro delivers a high performance 486 system at a low end price. Others can only offer a 386/SX for less than $1000 or substitute an imitation 486 that's more like a 386, FastMicro puts 25MHz 486SX power in your hands. Plus this isn't a 'bare' system, you get a system that's complete and ready-to-run right out of the box, including a Super VGA color monitor and card.

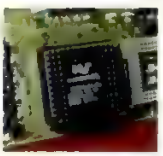
Loaded with Memory & Storage

FastMicro also includes four full megabytes of high-speed SIMM memory! You can even expand the memory to a total of 32MB. Of course, how can you also expect to get a hard drive at this price? Well, FastMicro includes a quality Conner hard drive with an unbelievable 85MB capacity. Plus, since it's a standard IDE drive, you can easily add a second hard drive later.



Upgradable to Overdrive Processors!

The best part of this system is that you get legendary FastMicro upgradability too! Besides upgrading the memory and drive, you can upgrade later to a faster Intel processor. This system is completely Intel OverDrive™ compatible; which means you can upgrade your FastData 486 system all the way to a 66 MHz 486DX/2! And like all FastMicro systems, you can upgrade monitors, drives, etc. when you order.



Plus, It's from FastMicro!

Pay less and get more! FastMicro backs up this system with seven day a week toll-free technical support and express parts replacement at no extra charge. And should you have an unusual problem, we'll send GE on-site service or replace the system at no additional cost! We also include BBS support and a 30 day money-back satisfaction guarantee too! Try a FastMicro 486/Valueline PC, you'll agree that they offer a lot of power for the price.

GE Computer Service

4SX/25 $999

- i486SX™ 25mhz Processor with 8K Interna Cache & 64K Static Ram Cache.
- 486 Overdrive™ Processor Upgradable.
- 4 megabytes of high speed RAM.
- 85 mb 17ms IDE hard disk,.
- 1.44mb 3.5" floppy drive.
- Mini-Tower Chassis.
- 14" SVGA monitor, 1024x768 resolution.
- 16 bit SVGA card.
- Clock calendar, parallel port, game port and two serial ports.
- 6 expansion slots, 2 occupied.
- Microsoft DOS 5.0.

FASTMICRO

1-800-824-6000

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the file before running the macro.

To use the macro, first clear out unnecessary codes from your text. Note that the macro will not work in WordPerfect 5.0, because it depends on the {SYSTEM} and {VARIABLE} commands, neither of which is available in 5.0.

As always with WordPerfect, the commands in the macro are indicated by curly brackets and will show in boldface onscreen when entered properly. To enter the {;} command (which indicates a comment) or the commands that show with all caps, type Ctrl-PgUp from the macro-editing screen and choose the command from the pop-up list. To enter the commands that show in uppercase and lowercase, either type the appropriate keystroke (such as Shift-F10 for {Retrieve}) or—for keystrokes that are active within the macro-editing screen, such as {Backspace}—type Ctrl-V and then type the keystroke. Spaces, like the one just before the {Retrieve} command, show as dots.—*M. David Stone*

Spreadsheets

QUICKEN-LIKE DATES

TIP I like the way Quicken lets you enter and adjust dates. Press the Plus key and the date field moves forward a day; press Minus and it goes back one day. Because 1-2-3 doesn't offer this kind of convenience, I wrote the macro shown in Figure 4. The macro enters a date in the current cell and then waits for the user to press a key. A series of {if} statements examines the keystroke and takes appropriate action—incrementing the date if the user presses Plus, decrementing if the user presses Minus, and so on. PgUp moves the date ahead one month; PgDn moves it back a month. The Enter, Up, and Down keys lock in the date and terminate the macro. The Esc key terminates the macro after erasing the date—giving the user a graceful way to back out.

This works in any version of 1-2-3 and can be used in a macro library managed by the MACROMGR add-in.

Rob McCormack
Thunder Bay, Ontario, Canada

▶PC MAGAZINE Date entry has always been a pain in the neck in 1-2-3 Release 2.*x*. In Release 3.*x* and 1-2-3 for Windows you can assign the "Automatic" format to a cell or range and then enter dates as dates. For example, if you type the date 8/30/92 in an Automatic-formatted cell in Release 3.*x*, 1-2-3 displays 8/30/92 and records the appropriate serial date value. In Release 2.*x*, however, you're stuck with typing @DATE(92,8,30)—unless you take matters into your own hands with a macro such as Mr. McCormack's.

Mr. McCormack's handy macro would be a welcome addition to almost any macro library. When you type it in, be sure to create the appropriate range names. Just use /Range Name Labels Right and select A1..A20. Also, you'll want to enter some reasonable initialization value in cell B20. If you leave B20 blank the first time you run the macro, the date that's entered in the current cell will be December 31, 1899—the date corresponding to a serial value of 0.

QDATE.WK1

Complete Listing

```
   A                    B
1  \D          +ddate~/rfd1~
2  LOOP        {get KEY}
3              {if KEY="{esc}"}/re~/rfr~{quit}
4              {if KEY="~"}{branch QUITIT}
5              {if KEY="{Up}"}{branch QUITIT}
6              {if KEY="{Down}"}{branch QUITIT}
7              {if KEY="+"}{let DDATE,DDATE+1}~
8              {if KEY="-"}{let DDATE,DDATE-1}~
9              {if KEY="{Home}"}{let DDATE,@NOW}~{branch \D}
10             {if KEY=" "}{let DDATE,DDATE+1}~
11             {if KEY="{Pgdn}"}{let DDATE,DDATE-365/12}~
12             {if KEY="{Pgup}"}{let DDATE,DDATE+365/12}~
13             {branch LOOP}
14
15 QUITIT      {let DDATE,@INT(DDATE)}~
16             /rv~~
17 KEY
18             {Quit}
19
20 DDATE       00000
```

Figure 4: **This 1-2-3 macro lets you enter dates and alter them the way Quicken does—with the Plus and Minus keys.**

QDATE2.WK1

Complete Listing

```
   A                    B
1  \D          {let DDATE,@now}~+DDATE~/rfd1~
2              {if @cellpointer("width")<10}/wcs10~
3  LOOP        {get KEY}
4              {if KEY="{esc}"}/re~/rfr~{quit}
5              {if KEY="~"}{branch QUITIT}
6              {if KEY="{Up}"}{branch QUITIT}
7              {if KEY="{Down}"}{branch QUITIT}
8              {if KEY="{Right}"}{branch QUITIT}
9              {if KEY="{Left}"}{branch QUITIT}
10             {if KEY="+"}{let DDATE,DDATE+1}~
11             {if KEY="-"}{let DDATE,DDATE-1}~
12             {if KEY="{Home}"}{let DDATE,@NOW}~{branch \D}
13             {if KEY=" "}{let DDATE,DDATE+1}~
14             {if KEY="{Pgdn}"}{let DDATE,DDATE-365/12}~
15             {if KEY="{Pgup}"}{let DDATE,DDATE+365/12}~
16             {if @exact(KEY,"Y")=1}{let DDATE,DDATE+365}~
17             {if @exact(KEY,"y")=1}{let DDATE,DDATE-365}~
18             {branch LOOP}
19
20 QUITIT     {let DDATE,@INT(DDATE)}~
21             /rv~~
22 KEY        {ESC}
23             {Quit}
24
25 DDATE      33849.608
```

Figure 5: **This macro does what the one in Figure 4 does, but it starts by entering the current date rather than the last date used. It also checks to see if your column is wide enough for the date format and widens the column if it isn't.**

FASTMICRO DIRECT EXPRESS

Hitachi SuperScan 20 $1479

Hitachi NSA's best value in a 20" monitor. An excellent choice for publishing, CAD/CAM, windowing, multimedia, and large screen business applications. Compatible with Standard and high refresh controllers including VGA, Super VGA, EVGA, XGA, 1024 x 768 and 1280 x 1024. The SuperScan 20 has a 31 dot pitch and an auto sync range of 30-64 KHz horizontal and 50-100 Hz vertical. UPS shippable

Microsoft Money $15

Easy data entry, personal or business expense tracking, quick and accurate reporting help you take control of your finances. Use it to write checks, set budgets, track expenses, or plan ahead. Money gives you fast and flexible ways to enter, report, and review your financial information. Price valid through 12/92.

CA-Textor $83

CA-Textor is a full-featured word processor that offers total word mastery with such advanced features as: dynamic user-defined dictionaries coupled with a complete spell checker and thesaurus (in American & British English and French languages), full editing capabilities in both preview and draft mode, an MDI interface which permits you to work on multiple documents simultaneously, embedded graphics, an advanced table editor, a unique calculation facility that enables you to perform up to 70 functions, and much more!

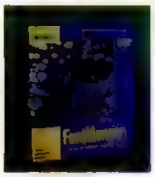
PC Stylus $63

Advanced pointing device that's lightweight, sleek and eliminates hand fatigue. Perfect for laptop and notebook PC's. The PC Stylus needs no pad, so it will work off a piece of paper or magazine cover. High resolution and precise tracking with a resolution of 400-1200 DPI makes it easy to work with fine details. It works off any mouse driven system, and is compatible with Microsoft Mouse and Windows.

Norton Desktop for DOS $109

The Norton Desktop for DOS reduces learning time and frustration, and increases productivity for any DOS user. Launch programs from a menu. View, print, copy, backup, and protect your data files easily, all without knowing a word of DOS! On-line help is thorough and comprehensive and an easy-to-use quick reference card is included.

FontMonger $97



Fontmonger software is for converting, enhancing, and modifying typefaces. FontMonger converts fonts in any direction between Post-script Type 1, 2, & 3, Nimbus Q, and True-Type. FontMonger also converts Intellifont into any of the other formats. Converted fonts can be saved for use with PC's, Apple Macintosh and NeXT too! With FontMonger you can combine typefaces and remap keyboard characters.

Microsoft Office $447

Microsoft Office for Windows includes the latest versions of four full-featured, easy-to-use applications for the Windows operating system. These leading applications are designed to work together to make it easier than ever for you to combine text, graphics, and data in great-looking documents. Applications include Word, Excel, PowerPoint and now mail.

HARDWARE

CD & MULTIMEDIA

Creative Labs Internal Multimedia Upgrade Kit $559

Includes: Sound Blaster Pro stereo sound card, Creative Labs internal CD ROM drive and a library of software (Microsoft Windows 3.1, Microsoft Bookshelf, Microsoft Works for Windows, MacroMind Action!, Authorware Star, Mathmatica Tempra, & Sherlock Holmes.

CD-ROM Software

Artshow by Corel	49
Baseball's Greatest Hit	49
BattleChess	45
Carmen SanDeigo	59
Sports Illustrated Almanac	39
Book of Mammals	49
Encyclopedia	69
MS Bookshelf, Stat. Pack, World Atlas & Consultant	99
MS Multimedia Beethoven	55
MS Multimedia Bookshelf	125
PC SIG Shareware CD	99
U.S. Atlas w/ AutoMap	69
World Atlas	49

Video Blaster $319

The ultimate in video versatility for multimedia computing. Integrate video from a wide range of sources - video cameras, VCRs, TV - with your PC applications. Runs within Windows and lets you combine video with text & graphics.

CD-ROM Hardware

NEC Ext. CD Express w/CDR25	419
Pinnacle Internal CD-Rom w/Atlas	319
Sony Int. CD Drive Kit	349
ATI Stereo F/X	109

Creative Labs

Multimedia Kit CD-ROM & SB Pro	559
Sound Blaster	95
Sound Blaster Pro (stereo & MIDI)	179
Video Blaster	319

Media Vision

ProAudio Spectrum Plus / 16	179/197

DRIVES

Seagate 130mb IDE Kit $329

IDE performance, big 130 megabyte capacity, 19ms access time and 5 mbps transfer rate make this a great buy. Controller, cables and rails are included to make installation fast and easy.

Colorado

DJ-10 40-120mb Int. Tape	199
DJ-20 80-240mb Int. Tape	259
External Kit w/AB11	99
Trakker 120 mb / 250 mb	369 / 439

DTC

6282-24 24mbit/sec transfer rate	125

Maxtor

7120A 120mb 15ms IDE	299
7213A 213mb 15ms IDE	399

Micropolis (see DTC Controllers)

MC1864 345mb HH ESDI 14ms	899
MC1568 668mb FH ESDI 14ms	1279
MC1518 1.3gb FH ESDI 14ms	2139

Plus Development

HardCard IIXL 50mb 9 ms 16bit	249
HardCard IIXL 105mb 9 ms 16bit	399

Quantum

LPS52A 52mb 9ms IDE	199
LPS120A 120mb 9ms IDE	309
LPS240A 240mb 9ms IDE	579

Teac 1.44mb 3.5" or 1.2mb 5.25" Floppy Drive $59

Genuine Teac quality at a low FastMicro price... these high density floppy drives also read, write & format low density floppy disks. They work great with all true 286, 386 & 486 compatibles. 1.44 mb 3.5" drive includes mounting kit and bracket. For rails for 1.2mb 5.25" drive, add $5.

DRIVES CONT.

Seagate

40MB ST351A 28ms IDE Drive	169
105MB ST3120A 19ms IDE Drive	259
125MB ST3144A 19ms IDE Drive	299
245MB ST3283A 12ms IDE Drive	549
425MB ST1480A 14ms IDE	819
1.42GB ST41650N 15ms SCSI	2199

Teac

1.2MB 5.25" Floppy	59
1.44MB 3.5" Floppy	59

Toshiba

360K 5.25" Floppy (Black)	59
1.2MB 5.25" Floppy	59
1.44MB 3.5" Floppy	59

Western Digital

WDAC280 80mb IDE 20ms	239
WDAC2200 200mb IDE 20ms	399

MODEMS

ATI

2400 ETC V.42 Int. / Ext.	75/99
9600/E External MNP V.42bis	279

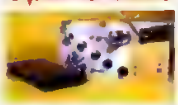
Best Data Traveler 9624FP 109

Everex 2400B Int Modem 65

Hayes

Optima 24 + Fax96	149
Optima 96 + Fax96	369
Ultra 144 Ext.	669
Pocket Edition 2400 Modem	119

Optima 9600 $349



Hayes quality and affordability in this V.32 9600 bps modem. V.42bis boosts throughput to 38,400 bps. It also includes V.42 & MNP 5 error correction and automatic feature negotiation for the most efficient performance.

Intel

Classic 2400 Modem Int./ Ext	139/159
Satisfaction Int. 100/ 200	99 /299

Practical Peripherals

2400B Int Modem Std/MNP	79 /119
PM9600SA Int. / Ext.	279 /299
PM14400FX Int. / Ext.	379 /419

USRobotics

9600 Sportster Int / Ext.	399 /449
Courier HST 14,400 Int. / Ext.	539 /559
Courier HST 14,400 Dual Std Ext.	799

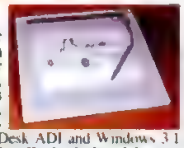
ZOOM

14.4 Int. / Ext.	265/295
2400b Internal Modem	59
9624 Send/Receive Int Fax Modem	79

MICE & INPUT

Key Tronic 101 Keyboard 59

Kurta XLP1212 $249



Whether you're a graphics or CAD user, the XLP is easy to use. Drivers include AutoDesk ADI and Windows 3.1 support. Bundle includes 4-button cursor, pen and lifetime warranty. XLP-1218 available for $499

Logitech

Mouseman Serial righthand	65
Mouseman Bus righthand	65
Mouseman Cordless	85
FotoMan	499
ScanMan 32	139
ScanMan 32 w/ Catchword	179
ScanMan 256	259
ScanMan 256 w/ Catchword Pro	299
Trackman 9/25	75
Trackman Portable	95

Microsoft

Serial or Bus Mouse only	89
Serial with Windows	147
Ballpoint	119

NETWORKING

Artisoft/Lantastic

Lantastic for Windows	165
Lantastic 2 Station Ethernet Kit	469
Ethernet Additional Stations	209

Eagle

NE2000 2 Station NW Lite Kit	419
NE1500 16 Bit 10baseT Adapter	149

FastData NE2000 16 Bit 10-BaseT 109

Intel EtherExpress 16 or 16TP 129

Novell Netware Lite 1.1 w/ DR DOS 65

VIDEO & MONITORS

ATI

Graphics Vantage 1mb	219
VGA Basic 16 / Integra	65 /79
VGA Wonder XL24 1mb	149
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Diamond

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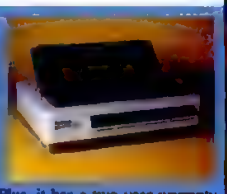

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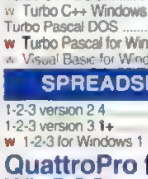

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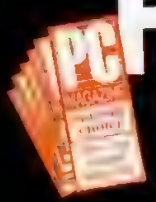

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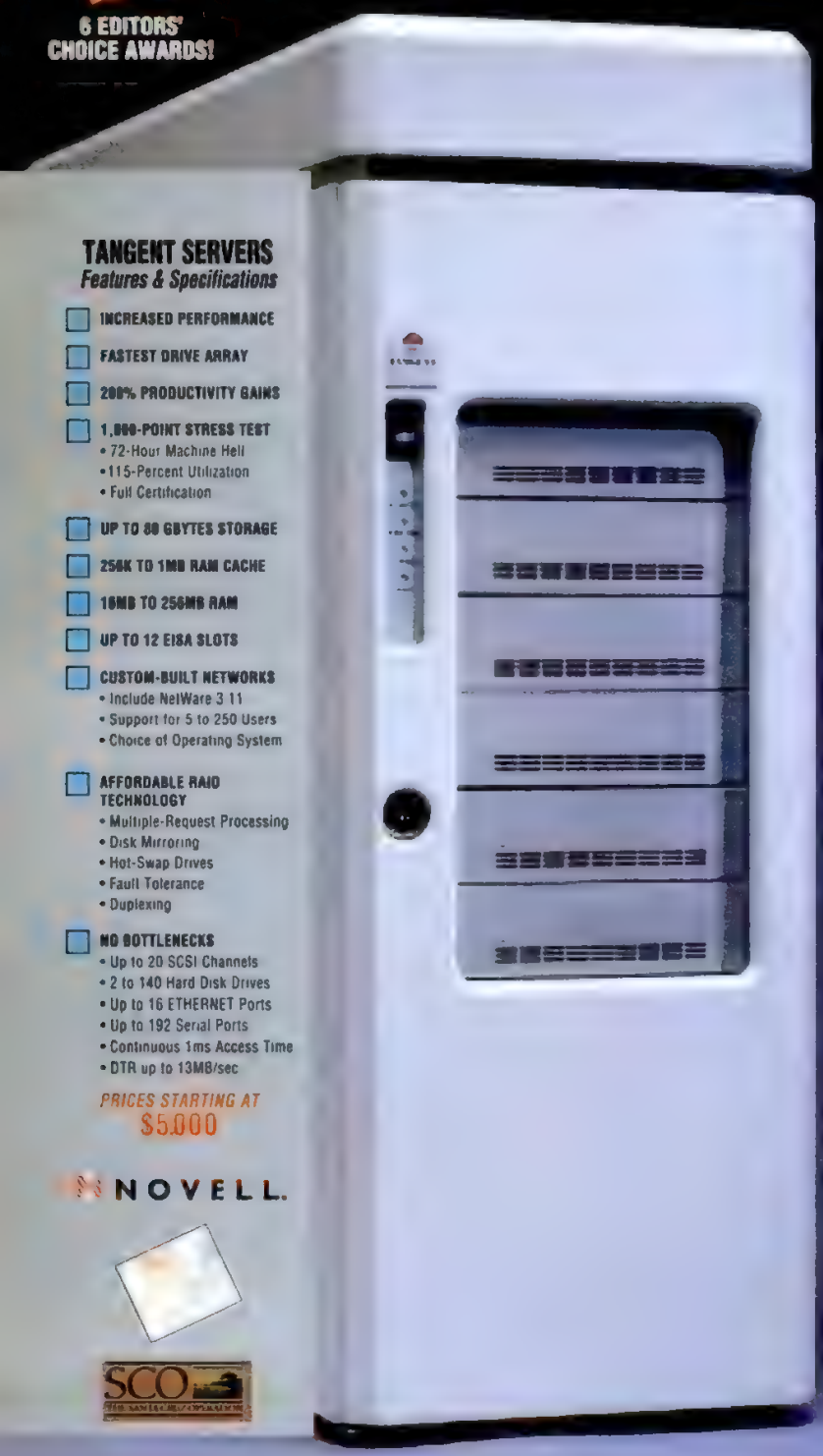

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CIRCLE 83 ON READER SERVICE CARD

As submitted, each run of Mr. McCormack's macro starts out by giving you the date you used last. For example, if you run the macro and use the Plus and Minus keys to get the date December 25, 1992, then the next time you use the macro, the date you get first will be December 25, 1992. An alternative approach would be to have the macro begin by initializing B20 to the current date. This variation is shown in Figure 5. In that figure, I've also added a line of code (B2) that checks to see whether the current column is wide enough to display a date in the DD-MMM-YY format. If the width of the column is less than ten, the macro increases it to ten.

Other changes in Figure 5 allow you to terminate the macro with the Left or Right Arrow key, press a capital Y to advance the date by a year and lowercase y to set the date back by a year. You can download both QDATE and QDATE2 from the Utilities/Tips Forum on PC MagNet.—*Craig Stinson*

VERTICAL HEADINGS

TIP I got tired of having to widen columns in 1-2-3 to fit headings, so I wrote the WYSIWYG macro shown in Figure 6. The macro creates vertical headings for the columns. It also uses WYSIWYG to create a blank graphics box, pauses to let me enter text and then rotates the text 90 degrees.

A quirk in 1-2-3 reduces the text font so that it is unreadable. I get around this by including :Graph Edit Options Font-Magnification in the macro. Finally, the macro uses :Graph Settings Opaque No to make the graphics box transparent. That way, if I've used any rules or shading in the same area as the text, those settings remain visible.

Larry Faithful
Simpsonville, South Carolina

▶**PC MAGAZINE** The ability of Lotus 1-2-3's WYSIWYG add-in to rotate text can sometimes be a real boon. Mr. Faithful's macro produces a label that reads vertically from bottom to top—suitable perhaps for positioning to the left of a worksheet table. You could write a similar macro that would apply two more quarter-turn flips to the text, producing a label that reads from top to bottom. To

VLABEL.WK1
Complete Listing

```
     A          B
1    \V         {windowsoff}{paneloff}
2               :gab.{d 3}~
3               e~a{panelon}t
4               <?}~~{paneloff}
5               tq
6               of700~q
7               :gson~q
8               {windowson}{panelon}
```

Figure 6: **This WYSIWYG macro rotates labels 90 degress so that you needn't widen a column in a 1-2-3 spreadsheet to fit its heading.**

do this, simply change the

```
tq
```

in B5 of Mr. Faithful's macro to

```
tqtqtq
```

At the 700 percent magnification selected by the macro, the {d 3} in cell B2 leaves room for a label of, at most, seven or eight characters. By replacing the {d 3} with {?}, you can have the macro pause and allow you to specify the size of the graphics box yourself.

Unlike a text field created with WYSIWYG's :Text Set command, a rotated label of the kind created by Mr. Faithful's macro is considered by WYSIWYG to be a graph. To change its contents, you'll probably want to delete the graph and start again. Just use :Graph Remove and then reinvoke Mr. Faithful's macro. You can download VLABEL.WK1 from the Utilities/Tips Forum on PC MagNet.—*Craig Stinson*

Databases

DUAL-MONITOR DEBUGGING

TIP Debugging can be the slowest and most frustrating aspect of any kind of programming. Suppose you want to run a PAL script and know when a particular procedure is entered or keep an eye on a certain variable. While the PAL debugger or even MESSAGE will do the job, they can both slow the process and interfere with your view of the application.

A very satisfactory solution is to use two monitors. PCs can support both a color card/monitor (CGA, EGA, VGA, and so on) and a monochrome card/monitor (MDA, HGA, and so on) at the same time. Since monochrome has slipped out of vogue, you should be able to find good used monitors and cards at a low cost. Check with rental stores or your local dealer. Installation should be as simple as putting the monochrome adapter into a vacant slot, but first check your system documentation and consult technical support or a local hardware guru.

Once the display is installed, type MODE MONO to test that your new monitor is working. (Type MODE CO80 to return to your primary monitor.) Although there are different ways to write to a secondary monochrome monitor, the following approach is the easiest I have found to write to a second while retaining the ability to write to the first. It involves using a public-domain device driver named OX.SYS.

With OX.SYS loaded (via CONFIG.SYS), anything redirected to the AUX device appears on the monochrome display. For example, the DOS command

```
DIR > AUX
```

would cause the current directory listing to appear on the monochrome display. Similarly, issue the DOS command

```
ECHO Another Rainy Day > AUX
```

and those three words appear on the monochrome monitor.

OX.SYS and the AUX device are the basis of a technique you can use with Paradox. I've written a procedure called AUX that displays strings on the monochrome monitor. To use it, pass AUX the string to be displayed. For example, to display the value of a numeric variable named COUNT, use the statement

```
AUX("Count= "+STRVAL(COUNT))
```

The AUX procedure is as follows:

```
PROC AUX(msg)
   RUN NOREFRESH NORESTORE
   "ECHO "+msg+" >AUX"
ENDPROC
```

In this procedure, the RUN command causes Paradox to suspend itself, load a

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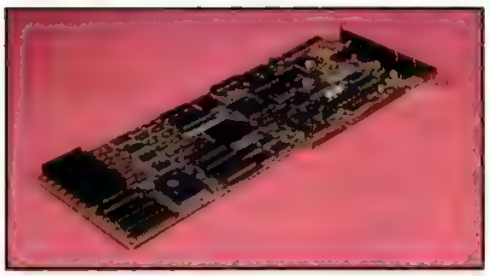

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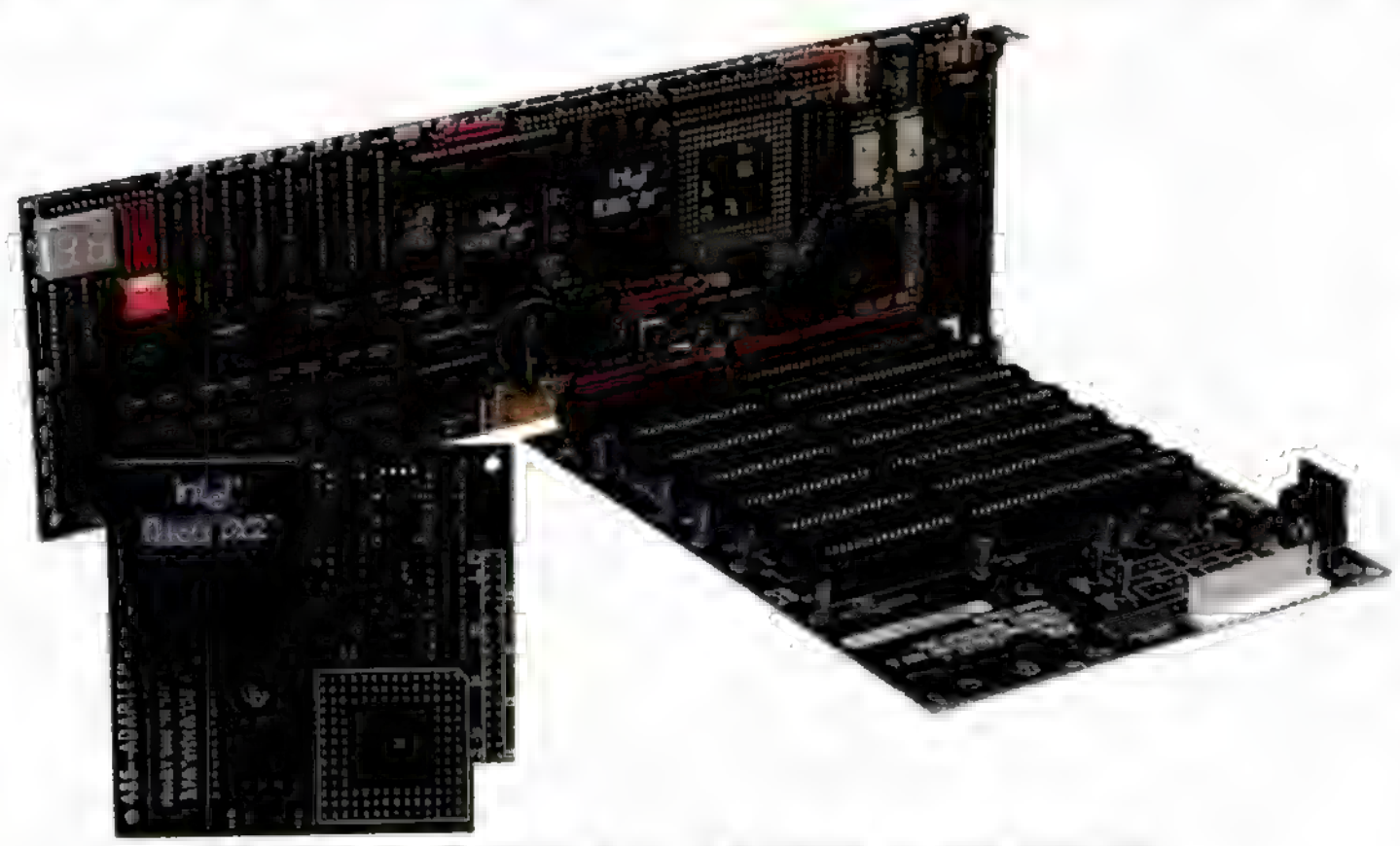

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Paradox AUX Procedures

Complete Listing

```
;*****************************************************
; PROC MonoMsg(msgexp) -
; Write an expression to the mono monitor
;  followed by a linefeed
;*****************************************************
PROC MonoMsg(msgexp)
PRINT FILE "aux" msgexp, "\n"
ENDPROC

;*****************************************************
; PROC TMonoMsg(msgexp) -
; Write a timestamped expression to the mono
;  monitor followed by a linefeed
;*****************************************************
PROC TMonoMsg(msgexp)
PRINT FILE "aux" time(), " ", msgexp, "\n"
ENDPROC

;*****************************************************
; PROC SMonoMsg(msgexp) -
; Write an expression to the mono monitor.
;*****************************************************
PROC SMonoMsg(msgexp)
PRINT FILE "aux" msgexp
ENDPROC
```

***Figure 7:* Three routines that can be used with OX.SYS for sending output to a secondary monochrome monitor from Paradox.**

copy of COMMAND.COM to run the ECHO command, and then return to Paradox. No changes occur on your color monitor, but you can easily spy on the PAL script by watching the monochrome display. Use a disk cache or put COMMAND.COM on a RAM disk (don't forget to set COMSPEC=), and your Paradox application will run at near full speed. Before shipping your completed product, be sure to comment out calls to the AUX procedure, or just the RUN statement in the AUX procedure.

Robert Scola
Issaquah, Washington

▶**PC MAGAZINE** I've been using a dual-monitor setup like this for many years to help me with my debugging efforts. It's convenient to run an application undisturbed on the color monitor while using the monochrome monitor for debugging. Though this technique seems less common in the database programming world, it is quite prevalent in the world of commercial software development. Many of my C, Pascal, and assembly language programming colleagues run a dual-monitor system, since most of the well-regarded debugging tools directly support dual-monitor debugging on the monochrome display (Periscope, SoftIce, CodeView, and Turbo Debugger, to name a few). Alas, in the database world, there is little support for secondary monitor debugging.

When the OX.SYS device driver is loaded, the AUX device becomes a synonym for the monochrome monitor. Thereafter, anything you do to AUX you are really doing to the monochrome monitor. Michael Geary, a well-known Windows programming expert, developed OX.SYS to debug Windows applications and placed it in the public domain. In the early days of Windows programming, there were few debugging tools available. However, by using the OX.SYS device driver and a few lines of C code, you could easily send values to the monochrome monitor for examination—without disturbing your application's display. The same approach can be applied in Paradox and in many other database software packages, too.

While Mr. Scola's technique of using the RUN command will work, there is a better way. Recall that DOS treats devices in much the same way that it treats files. That is, a device name can substitute for a filename. For example, if you type the line

```
COPY AUTOEXEC.BAT CON
```

DOS will dutifully copy your AUTOEXEC.BAT file to your standard output console device, which is your display; DOS accepts the device name CON in place of a filename.

Similarly, there are two Paradox commands that, while intended to accept filenames, will work with the AUX device name as well. They are PRINT FILE and FILEWRITE (which is a new command in Paradox 4.0). For example, Mr. Scola's routine could be rewritten in the following way:

```
PROC AUX(msg)
  PRINT FILE "aux" msg
ENDPROC
```

or

FoxPro AUX Procedures

Complete Listing

```
*************************************************************
* PROCEDURE MonoMsg - - Write an expression to the mono monitor
* followed by a linefeed
*************************************************************
PROCEDURE MonoMsg
PARAMETERS m1, m2, m3, m4, m5, m6, m7, m8, m9, m10
PRIVATE nHandle
nHandle = FOPEN("aux", 11)     && Open write only, unbuffered
FOR x = 1 to PARAMETERS()
  msg = "m" + ALLTRIM(STR(x))
  =FPUTS(nHandle, EVAL(msg))
ENDFOR
=FCLOSE(nHandle)
RETURN

*************************************************************
* PROCEDURE TMonoMsg - - Write a timestamped expression to the mono
* monitor followed by a linefeed
*************************************************************
PROCEDURE TMonoMsg
PARAMETERS m1, m2, m3, m4, m5, m6, m7, m8, m9, m10
PRIVATE nHandle
nHandle = FOPEN("aux", 11)     && Open write only, unbuffered
FOR x = 1 to PARAMETERS()
  =FWRITE(nHandle, TIME()+" ")
  msg = "m" + ALLTRIM(STR(x))
  =FPUTS(nHandle, EVAL(msg))
ENDFOR
=FCLOSE(nHandle)
RETURN

*************************************************************
* PROCEDURE SMonoMsg - Write an expression to the mono monitor.
*************************************************************
PROCEDURE SMonoMsg
PARAMETERS m1, m2, m3, m4, m5, m6, m7, m8, m9, m10
PRIVATE nHandle
nHandle = FOPEN("aux", 11)     && Open write only, unbuffered
FOR x = 1 to PARAMETERS()
  msg = "m" + ALLTRIM(STR(x))
  =FWRITE(nHandle, EVAL(msg))
ENDFOR
=FCLOSE(nHandle)
RETURN
```

***Figure 8:* Three FoxPro routines that can be used with the OX.SYS device driver to display values on a secondary monochrome monitor.**

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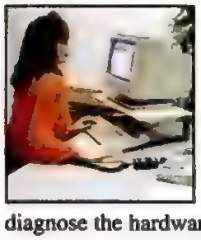

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CIRCLE 305 ON READER SERVICE CARD

```
PROC AUX(msg)
   FILEWRITE APPEND
   "aux" FROM msg
ENDPROC
```

Both of these will run faster and require fewer resources than running a second copy of COMMAND.COM.

Typically, when you are displaying values, you want to place them on separate lines. Sometimes it is also useful to precede a value with a time stamp or display a value on the same line as a previously displayed value. For these reasons, the routines shown in Figure 7 should come in handy.

The first, MonoMsg, displays your message followed automatically by a line feed. The second, TMonoMsg, does the same thing but precedes your message with a time stamp. The third, SMonoMsg, outputs your message as is, with nothing preceding or following. For example, the sequence

```
TMonoMsg("Hello")
MonoMsg("Hello")
SMonoMsg("Hello")
SMonoMsg("Hello")
```

would display the following:

```
20:37:19 Hello
Hello
HelloHello
```

If you aren't using Paradox, you may be able to put together a similar set of routines to use with your database package. All but a few programs include a way to send output to a DOS file in the form of low-level file input/output functions or a command similar to Paradox's PRINT FILE command. If your DBMS doesn't include this capability, you may be able to find a command like Paradox's RUN that will do the trick.

In FoxPro, for example, the FOPEN(), FWRITE(), FPUTS(), and FCLOSE() functions can be used to create a set of MonoMsg routines. The procedures shown in Figure 8 mimic their Paradox counterparts, except that I've designed them to accept up to ten values to display.

The procedures shown in Figures 7 and 8, along with OX.SYS and associated files, can be found in the file MONO.ZIP on PC MagNet. Look in the Spreadsheets/Databases Library of the Utilities/Tips Forum.—*Sal Ricciardi*

Graphics

SUPER-SIZE SUPERSCRIPTS

❓ I'd like to create type larger than 650 points within PageMaker 4.0. Can you tell me if it's possible?

M. McCormick
Queens, New York

▶**PC MAGAZINE** While you can't select a point size over 650, PageMaker can actually size type up to 1,300 points—that's more than 18 inches tall! The trick involves setting the type as a superscript rather than as normal text. Here's how:

First highlight the text you want to enlarge and open the Type Specifications dialog box (Control-T). Enter a value for the point size that is half the size you ultimately want. So, for example, if the text should be 1,000 points, enter half that amount, or 500. Now open the drop-down list for Position and choose Superscript. Clicking the Options button reveals a special dialog box that allows you to determine the relative size and position of Small Caps, Superscripts, and Subscripts. Enter 200% for the Super/subscript size. As you can see in Figure 9, this will effectively double the size of your text to 1,000 points. In order to keep the text aligned on the true baseline, you must also set the Superscript position to 0%. Click OK twice to accept these type specs and then return to your document.

Note that PageMaker's auto-leading feature will add linespacing based on 120 percent of the true type size (which is 500 points), not the superscript size of 1,000 points. This results in 1,000-point type on only 600 points of leading. You'll find it easier to position the type if you manually adjust the leading (PageMaker can handle leading up to 1,300 points).

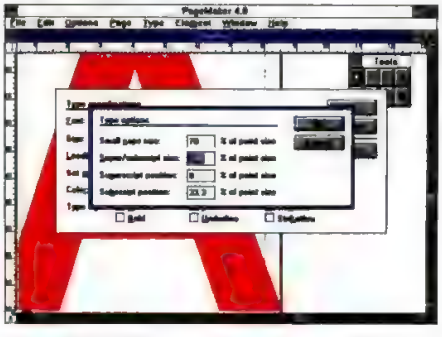


Figure 9: **By setting your type as a superscript, you can create type sizes of up to 1,300 points in PageMaker 4.0.**

This trick poses no danger to your document, but it can result in glitchy screen displays. Portions of your super-size text may disappear when you scroll down the page or move the object to a new position. Forcing a screen redraw will correct the problem.—*Luisa Simone*

Networking

ACCESSING TWO SYSTEMS

❓ Some of our users access two different computers (both through Wyse terminals), a small multiuser system and a mini. They can take printed reports generated on the minicomputer and manually key information into the office terminal, but transferring it directly would be far more efficient.

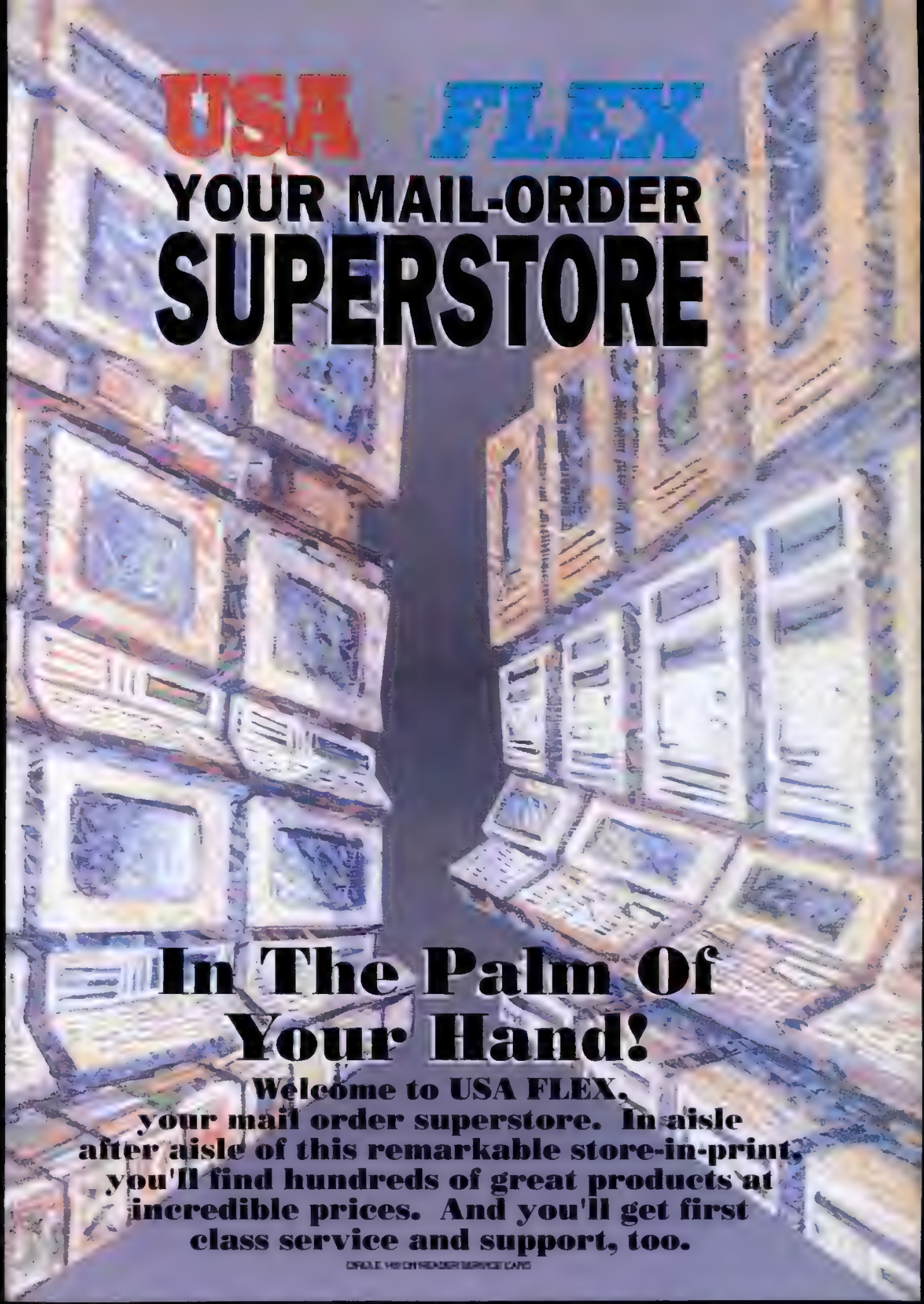
It seems like one PC emulating both terminals would provide the perfect solution, since cutting and pasting between the two screens would be a fairly easy task. Are there any communications packages that support this kind of setup, or would the machine need to run two separate copies of the software under a multitasker like DESQview or OS/2?

Also, the connections to the other systems would require two COM ports, but the system also needs a serial mouse, which would have to share the same IRQ as one of the ports. Would that cause problems?

Bill Renfroe
Mocksville, North Carolina

▶**PC MAGAZINE** DCA's Crosstalk Mk.4 can do everything you want, including cutting and pasting screen data between terminal emulation sessions. The program can handle simultaneous communication sessions over different COM ports, and it includes an excellent Wyse terminal emulator. You don't need a multitasking operating system; Crosstalk takes care of all that. The program carries a list price of $295, but the street price is about half that.

While the software will do everything you want, there might be some question about the serial ports handling the load.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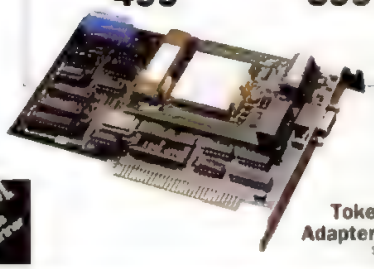

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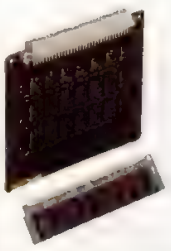

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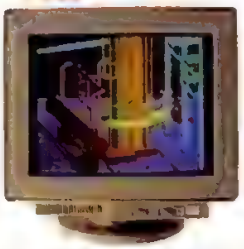

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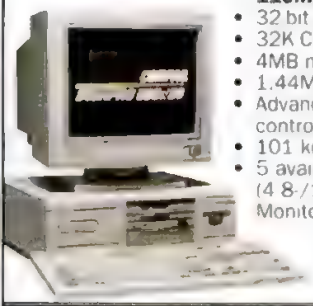

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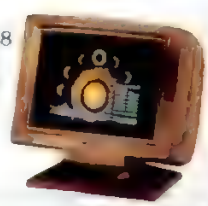

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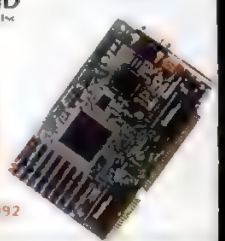

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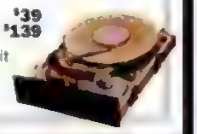

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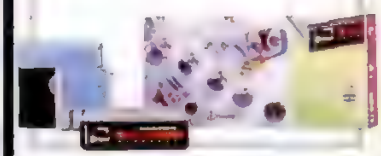

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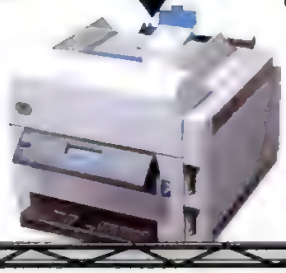

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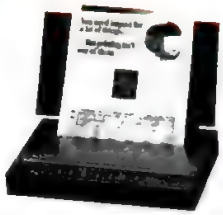
Canon



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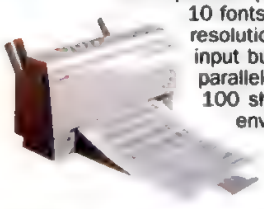

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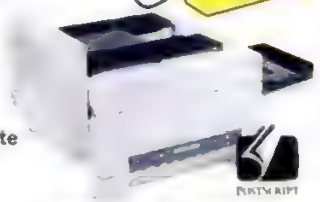

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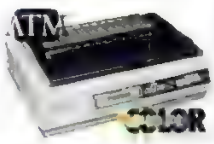

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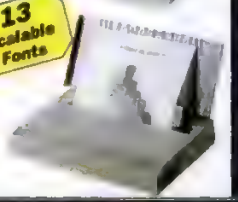

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SIMPLE NETWORKING UNDER WINDOWS

❓ We currently use two 386SX PCs and plan to add at least one more, as well as a 486. All of the machines will run WordPerfect under Windows at least part of the time, but two of them will run mainly dBASE applications. Data is going to be input on one of the dBASE systems, and reports will be created on the other. The remaining computers will be used just to exchange files. All four will share a single printer. Do you think that we need to install a true network?

Eric Webb
Elk Grove Village, Illinois

▶**PC MAGAZINE** If all you wanted was printer sharing, you wouldn't need a network—other products could solve your problems. But for shared file access you do need a LAN. Fortunately, you have at least three excellent alternatives for networking under Windows.

I suggest either Artisoft's LANtastic for Windows, 10NET for Windows (which is sold by both Sitka and 10NET Communications Systems), or Microsoft Windows for Workgroups. All three offer excellent integration between Windows and the network, and each company offers its products packaged with LAN adapters in economical starter kits.

Any of these offerings will meet your needs. Your decision boils down to this: Where do you want to go from here? If the possibility of using a DOS-based PC as a server lies ahead, then either 10NET or LANtastic might be the best choice. Artisoft offers more dealers and support, but 10NET allows greater flexibility in linking to other networks (such as LAN Manager) and through its ability to use different adapter cards. If you plan to keep everyone under Windows, you'll be comfortable with the tight integration you'll get between it and the network with Windows for Workgroups.

Prices for all of these products should cluster around $250 per node in the retail channel.—*Frank J. Derfler, Jr.*

Languages

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▶**PC MAGAZINE** Many programmers use the DOS environment to store information, perhaps to pass arguments to a program that's run using SHELL or to store variables that are common to all of the modules in a large application. Unfortunately, you often can't add new variables to the environment because of its limited

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INCENV.ASM

Complete Listing

```
;**** INCENV.ASM - increases the size of a BASIC program's environment

;Copyright (c) 1991 Ethan Winer


;Syntax: CALL IncreaseEnv(BYVAL BytesLarger%)

;NOTE: This routine will not work in the QB or QBX editor.


.Model Medium, Basic
    Extrn B$SETM:Proc       ;this is BASIC's internal SETMEM function

.Data
    Extrn __aenvseg:Word    ;this is BASIC's internal
                             ;environment segment
    Extrn b$env_len:Word    ;the length of BASIC's environment,
                             ;also internal
    Extrn __psp:Word        ;the PSP of the BASIC program

.Code

IncreaseEnv Proc Uses DI SI, Increase:Word

    Mov  BX,__aenvseg   ;get BASIC's environment segment
    Dec  BX             ;look at the segment before (its MCB)
    Mov  ES,BX          ;through ES
    Mov  AX,ES:[3]      ;the size is in the third byte of the MCB

    Mov  BX,Increase    ;see how many bytes larger it is to be
    Mov  CL,4           ;prepare to divide by 16
    Shr  BX,CL          ;convert from bytes to paragraphs
    Inc  BX             ;plus one more in case of an odd number

    Add  AX,BX          ;now AX holds the new size in paragraphs
    Push AX             ;save this for later
    Shl  AX,CL          ;convert the new size from paragraphs to bytes
    Push AX             ;save this for later too

    Add  AX,16          ;bump up an extra paragraph for headroom
    Neg  AX             ;convert to a negative version for SETMEM
    Cwd                 ;now that value is in DX:AX
    Push DX             ;pass it on to SETMEM
    Push AX
    Call B$SETM         ;now we can call DOS to claim memory

    Pop  CX             ;retrieve the new size in bytes
                         ;(was pushed as AX)
    Pop  BX             ;and retrieve again as paragraphs
                         ;(also pushed as AX)
    Mov  AH,48h         ;DOS Allocate Memory service
    Int  21h            ;claim memory for the new environment
    Jc   Exit           ;for some reason the memory request failed...

    Mov  b$env_len,CX   ;it worked, show BASIC the new maximum env. length
    Push DS             ;save DS before we trash it below

    Mov  ES,AX          ;we'll copy to the newly allocated segment
    Sub  DI,DI          ;all segments start at address zero
    Mov  DS,__aenvseg   ;copy from BASIC's environment
    Sub  SI,SI          ;also starting at address zero
    Cld                 ;copy forward
    Rep  Movsb          ;copy the old environment to the new segment

    Pop  DS             ;retrieve DS so we can get at BASIC's data
    Push DS             ;save it again for a moment
    Mov  __aenvseg,ES   ;show BASIC where its new environment segment is
    Mov  DS,__psp       ;now load the BASIC program's PSP segment
    Mov  DS:[2Ch],ES    ;and assign the new environment segment there
                        ; so DOS will know about the relocated environment

    Pop  DS             ;retrieve DS before returning

Exit:
    Ret                 ;
return to BASIC and restore the Uses registers

IncreaseEnv Endp
End
```

Figure 10: **This assembly routine lets you increase the size of a program's copy of the DOS environment.**

size.

When you run a program, DOS provides it with a copy of the parent's environment. When you run a program from the command prompt, the program receives a copy of the DOS master environment. But when you run another program by shelling from your BASIC program, the shelled program receives a copy of *your* program's copy of the environment. Furthermore, this copy is only as large as necessary to hold the environment variables that are currently defined, rounded up to the next multiple of 16 bytes. Therefore, it's usually impossible to add a new variable to the environment in a running program since only 15 or fewer bytes are available.

To solve this problem, I created the IncreaseEnv routine shown in Figure 10. You call IncreaseEnv with the number of bytes by which the environment is to be increased. For example, if you need to add a variable that will require 40 additional bytes, you'd pass the value 40 to IncreaseEnv. This argument is passed by value as shown in the source file header comments to slightly improve the efficiency of the code inside the routine.

IncreaseEnv works by allocating more than enough memory to hold an entirely new version of your program's environment, with more room available than the original version. It then copies the current environment's contents to the beginning of the newly allocated memory. Finally, BASIC's internal pointers that show where the environment is located are updated to hold the address of this new copy.

IncreaseEnv works by allocating memory to hold an entirely new version of your program's environment—but with more room than the original version.

There is one additional complication that IncreaseEnv must handle. When a BASIC program first runs, it claims all available DOS memory. BASIC allocates and frees that memory as you create and erase arrays and string variables. Thus, an assembly language routine cannot simply call the standard DOS memory allocation services, because no DOS memory is available. The solution is to first call BASIC's internal SETMEM routine (B$SETM), telling it to release some of BASIC's memory back to DOS. Once this is done, the routine can call DOS to allocate memory, confident that the request will be fulfilled.

IncreaseEnv is written in assembly language, and it must be assembled using MASM, Version 5.1 or later. Note that IncreaseEnv will not work with the QB or QBX editors within a Quick Library, because when the editor programs are being run, it is their environment being changed—not the one your program is accessing. IncreaseEnv also will not work with programs that depend on the BRUN support library. It is intended for use with standalone programs only (compiled using /O). (INCENV.ASM can be downloaded from the Programming Forum on PC MagNet.)—*Ethan Winer* □

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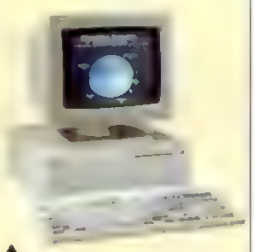

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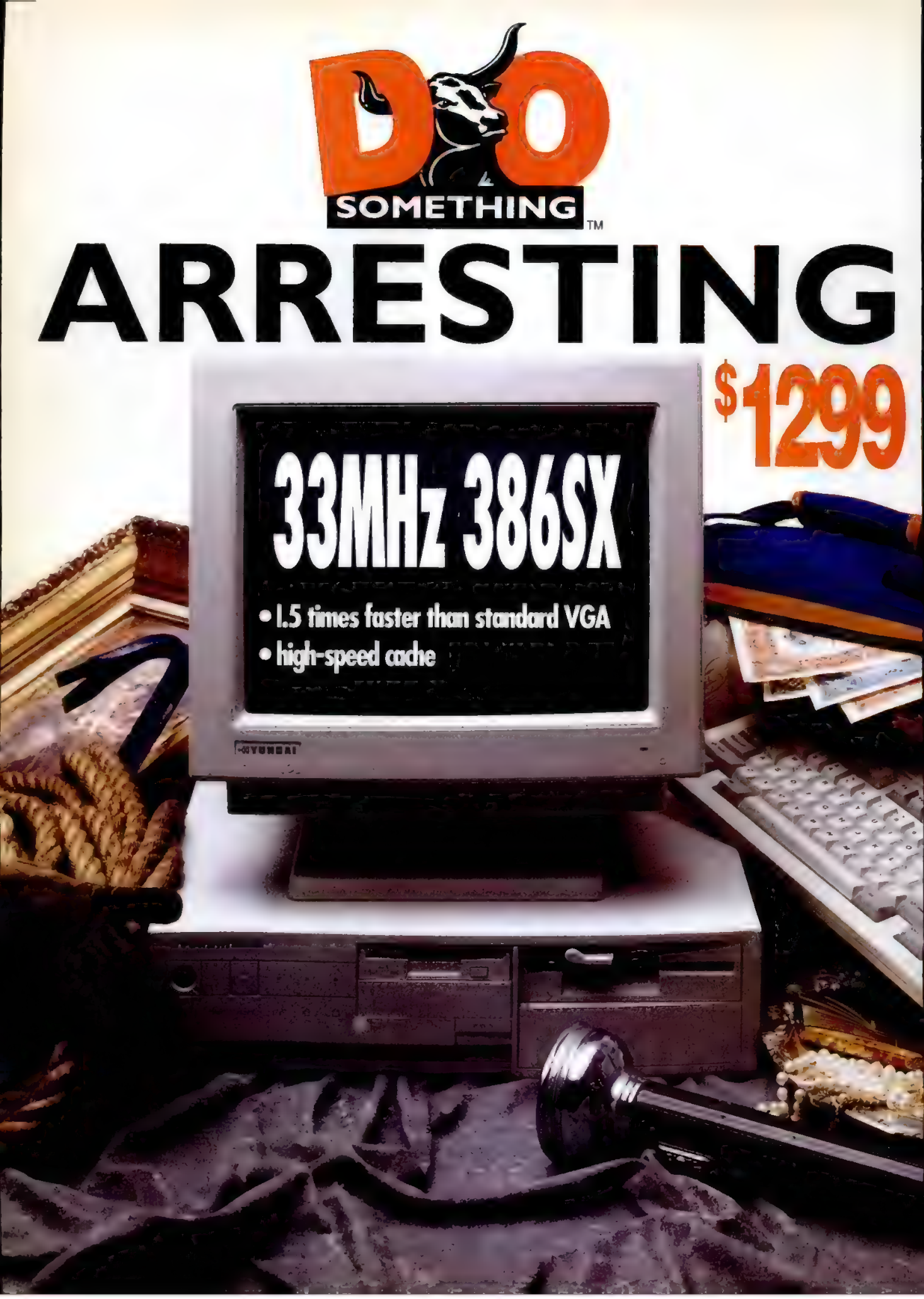
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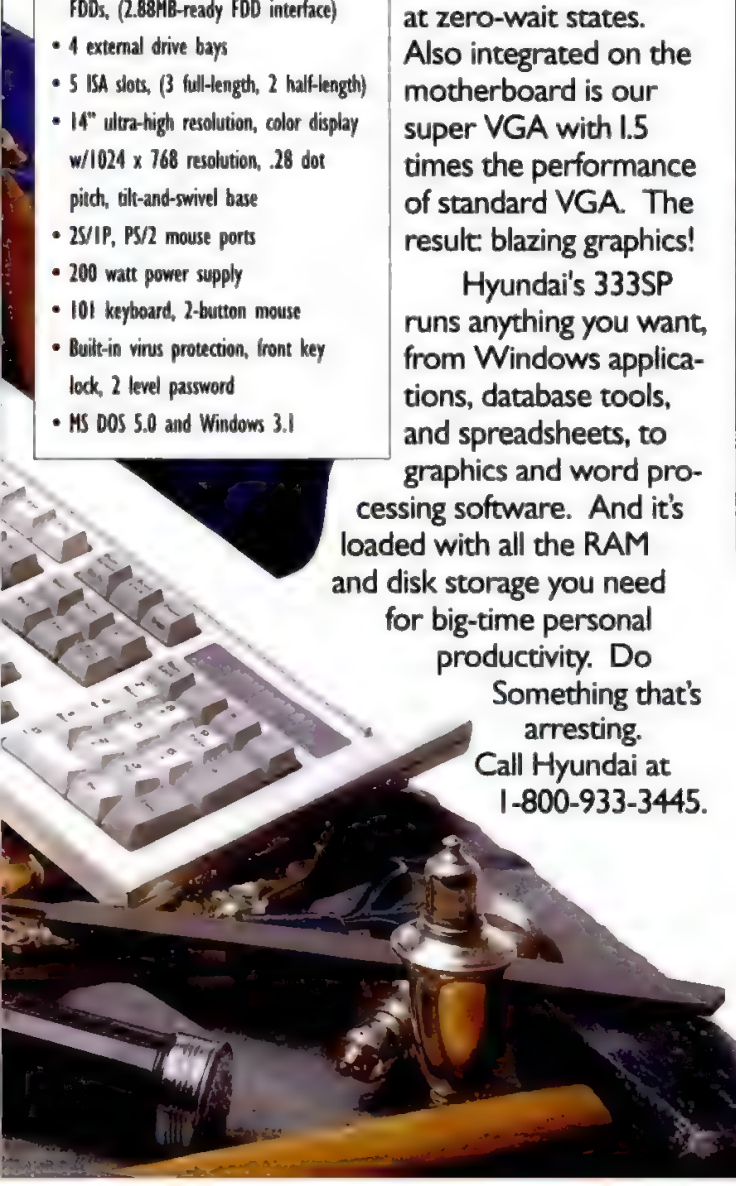

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Quattro Pro WinDOS / Norton Desktop for Windows Bundle

This is the powerful package that bridges the gap between Windows and DOS. That's because it includes Quattro Pro for both DOS and Windows, plus Norton Desktop for Windows. Quattro Pro for Windows was developed from the ground up to take full advantage of the Windows environment, resulting in a radically simplified yet powerful spreadsheet product.

In the Windows version of Quattro Pro, two unique technologies in particular provide you with a significant departure from traditional spreadsheet models. Spreadsheet Notebooks, based on the familiar tabbed paper notebook, organize spreadsheet data and dramatically improve the way you build and manage spreadsheets. Object Inspectors let you right-click on an object to display a list of options that can be changed for that object. Object Inspectors save time by letting you make multiple changes at a time. And of course you get point-and-click simplicity, comprehensive presentation graphics, and visual application building tools.

Plus, Quattro Pro for Windows offers compatibility with other database applications. When you get the Quattro Pro WinDOS Special, you get the best of both worlds—Windows and DOS.

As if that wasn't enough, we're throwing in the Symantec utilities package that millions rely on. Norton Desktop for Windows makes using Windows easier and more convenient by providing an integrated environment with drag-and-drop support across the entire desktop. It includes backup, anti-virus scanning and correction, a Windows text editor, additional file viewers, a comprehensive batch language with macro capability, a network install program to make installation and maintenance easier for MIS administration, and many award-winning Norton data recovery and diagnostics tools.Together, these two programs make the perfect bundle for any power user. Borland/Symantec **W #11747 - 5.25" disk • W #11748- 3.5" disk**

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Aldus **W #11190**

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- ▲ Automatic assistance with aligning, sizing and orienting objects helps you create accurate drawings quickly.
- ▲ Create symbols with clones of any graphic that can be changed automatically when you change the master.
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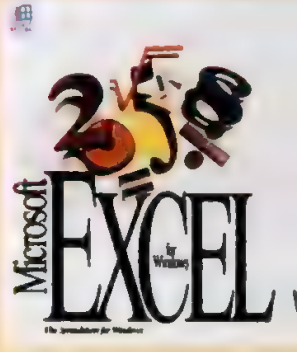

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Superior spreadsheet performance, consistency with other Microsoft applications and unmatched ease of use have won Microsoft Excel just about every top software industry award.

And if you need more reasons to choose Microsoft Excel for your spreadsheet program, take a look at its features.

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- ▲ The Utility toolbar is just one of the seven task-oriented toolbars that comes with Microsoft Excel 4.00.
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- ▲ Autosum will automatically calculate rows or columns.
- ▲ CrosstabWizard lets you easily create summary tables from databases.
- ▲ Scenario Manager helps you create and save multiple "what if" scenarios.
- ▲ Use the ChartWizard to create 3-D graphs or charts from the information in the Scenario Manager.
- ▲ Use the flexible 3-D Workbook solution for easy data consolidation. Excel lets you consolidate data from multiple worksheets and create a final consolidated worksheet, complete with outlining.

As you can see, Microsoft Excel version 4.0 gives you unprecedented power and ease of use. It gives you instant access to powerful features, including unmatched analytical functions, outstanding reporting and presentation tools, and extensive, easy charting. Microsoft Excel is power made easy.

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o cally transform scanned photographs and other bitmap images into
b dramatic painting-like artwork. With it almost anyone can create
o original artwork, add artistic touches to photographs for use in
n magazines, brochures, annual reports, and more.

T To bring your images to life, all you have to do is click. With Aldus
O Gallery Effects your photographs will turn into fine art.

▲ **Classic Art.** You'll begin with the 16 original effects fromVolume 1: Chalk & Charcoal, Charcoal, Chrome, Craquelure, Dark Strokes, Dry Brush, Emboss, Film Grain, Fresco, Graphic Pen, Mosaic, Poster Edges, Ripple, Smudge Stick, Spatter and Watercolor. And the Gallery Effects family is expanding, and you'll get FREE samples from other volumes.

▲ **Flexibility.** This package includes a stand-alone application for applying effects to images, and plug-in filters for interfacing with other graphics programs.

▲ **User Lovable.** Gallery Effects dialog boxes are consistently easy to understand and use, complete with interactive preview before you apply a style. Feel free to experiment.

I Discover for yourself how the Gallery Effects family lets you bring vibrant new life to all your
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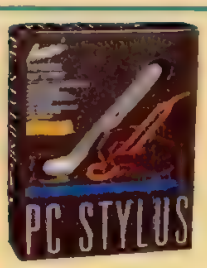

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PC Stylus

It's naturally easier to point with your fingers than with your whole hand. That is the idea behind the IMSI PC Stylus—to improve the clumsy pointing technique of a standard mouse. So instead of a fist-like grip, you use the PC Stylus like a pen on your desktop. Or, if you have no desk space, it also functions as a comfortable, thumb-actuated trackball. The moment you pick it up, you'll find its smooth responsiveness and improved control make it the obvious choice. IMSI B #11661
B #11296 **IMSI Mouse Serial** $34

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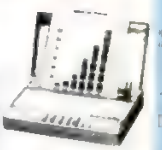

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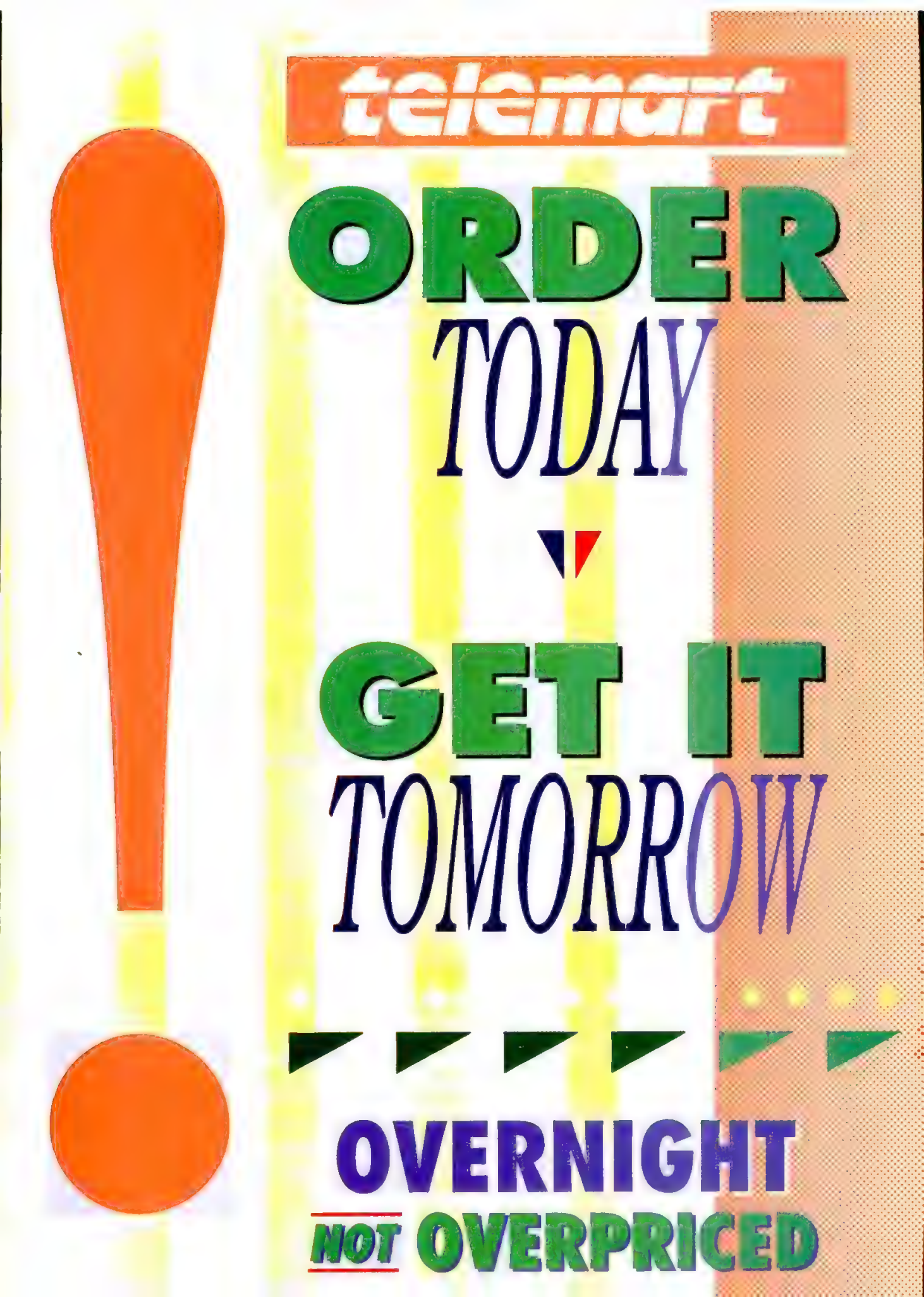
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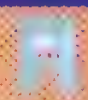

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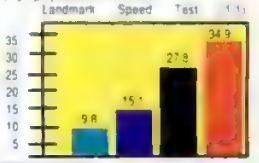

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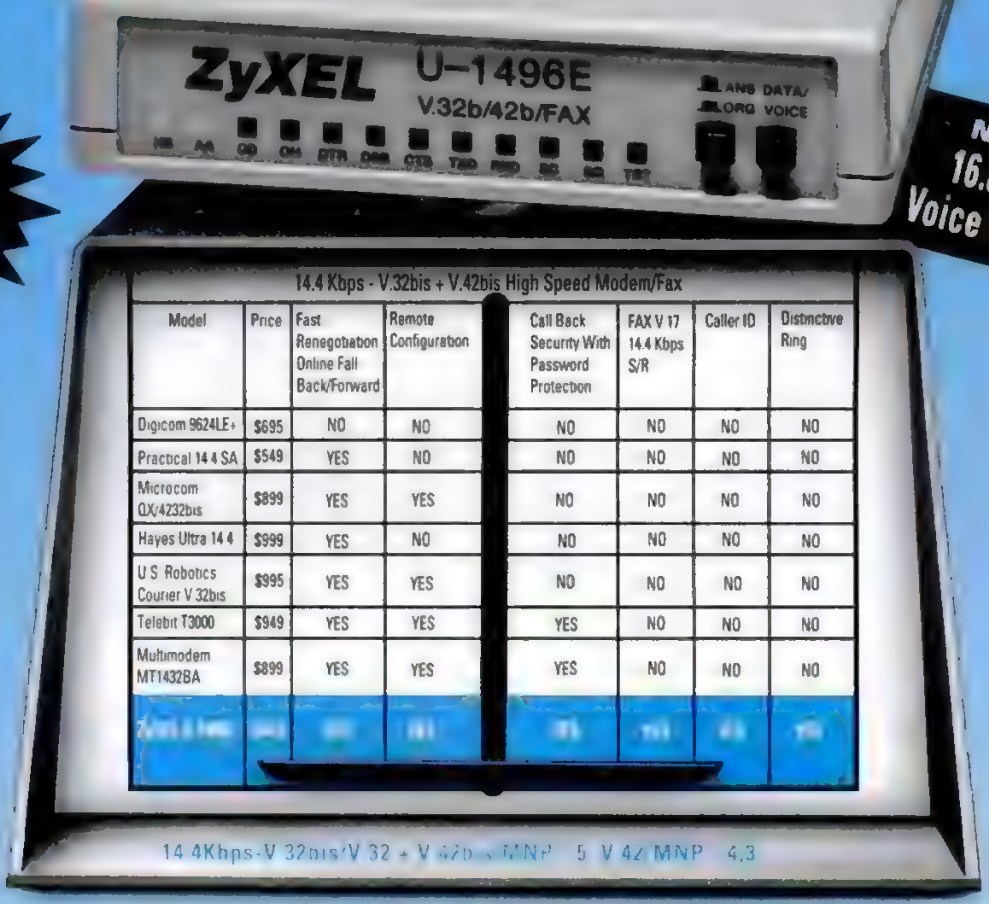

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Once you've weighed the options, you'll agree: Zyxel's U-1496E offers the best value for less than any other modem/fax in its class. So, don't hesitate. **Call Today.**

PC Awesome

Editor's Choice: ZyXEL U-1496E
German Edition, 4/92

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Comparison chart was completed in May 1992

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Time Slips V	177

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DCA Crosstalk Communicator	52
Procomm Plus 2.01	69
Laplink Pro IV	98
DOS FaxPro	47
Novell Products	call
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Winfax Pro 2.0	69

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dBase IV 1.5	489
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Clipper 5.01 (Single)	479

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Where World is Carmen	29
Where Time is Carmen	29
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Citizen PN48 PRO	347
Citizen PN48 STD	282

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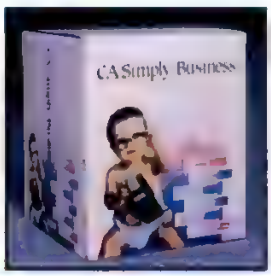

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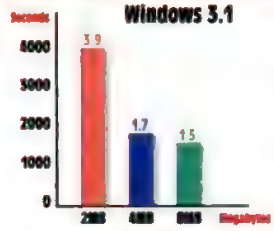

- An upgrade from 2MB to 8MB can increase performance up to 160%.
- Memory allows Windows to run faster.
- Reduces your system's need to access the hard disk.
- Speeds up programs which use virtual memory.
- Allows you to utilize numerous and extensive applications at the same time.

This graph displays the amount of time it takes to run one specific Windows application with the indicated amount of memory.

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4MB $100
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4MB $220
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Brother HL-8

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Panasonic 4450i and 4420i

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Panasonic LaserPartner 4455

2MB	KX-P442	$119			

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DeskJet 500 and 520

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3MB	N/A	$109	4MB	N/A	$189

DeskJet 510

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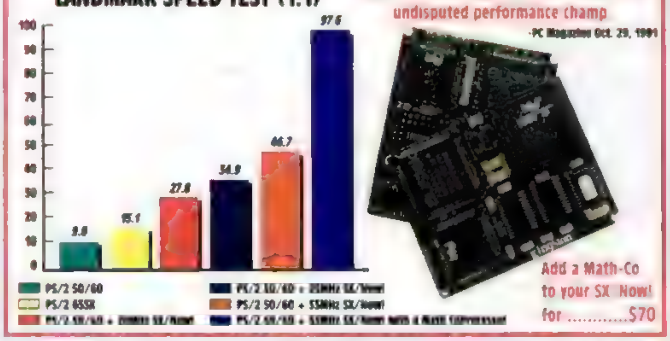

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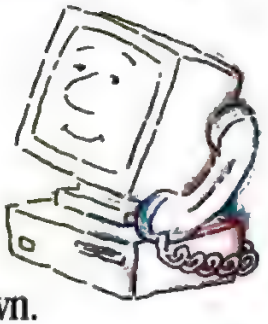

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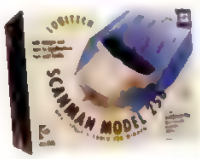

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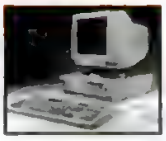

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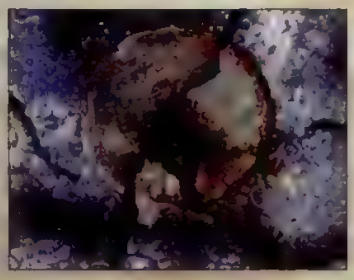

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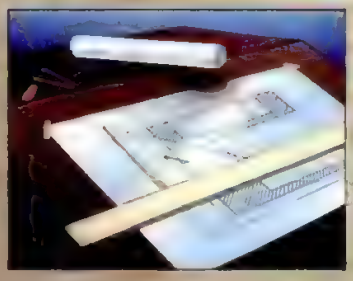

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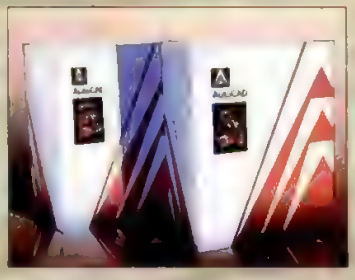

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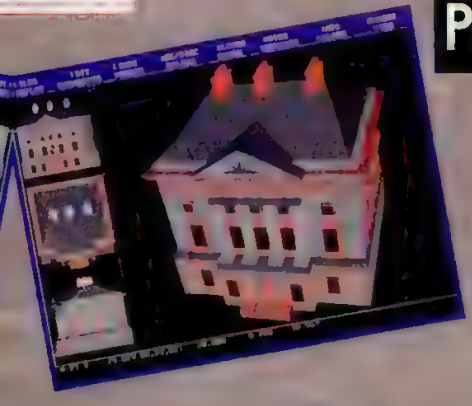

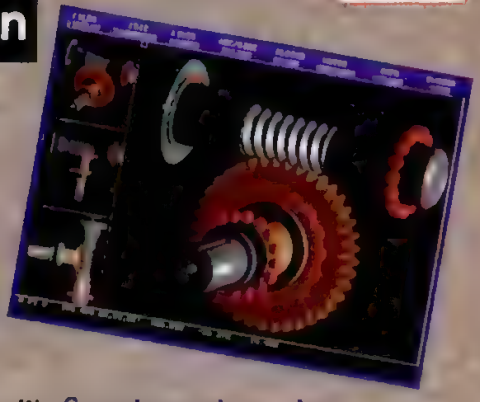

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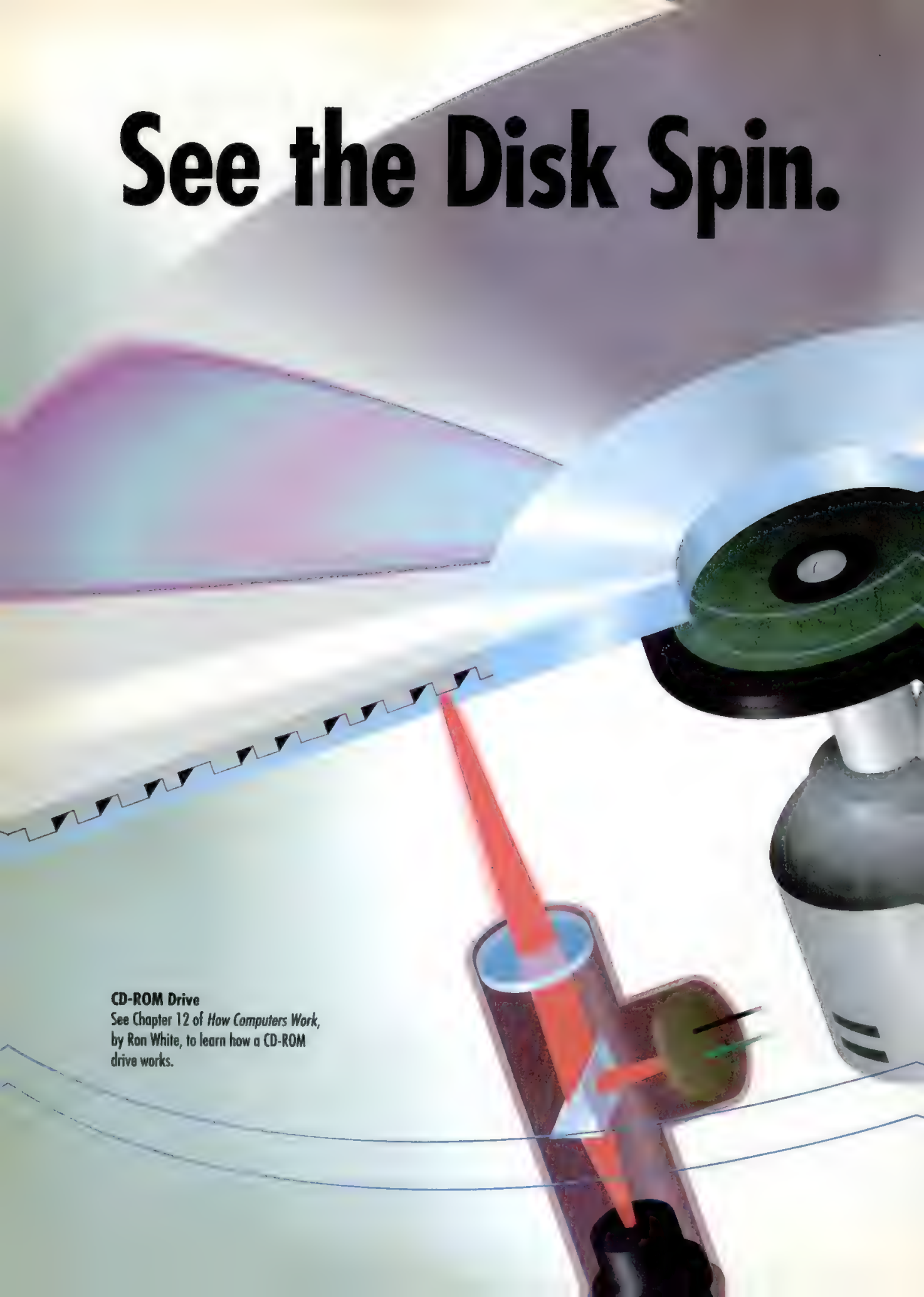

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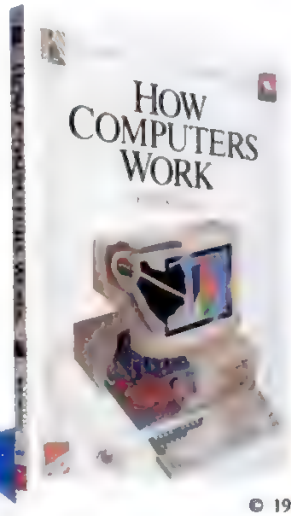

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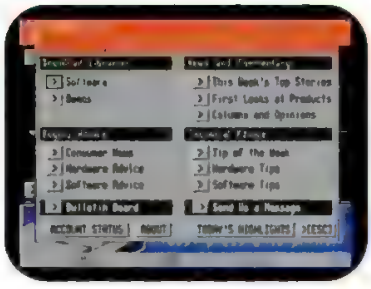

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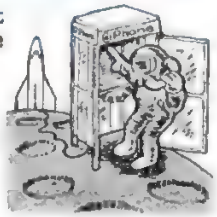

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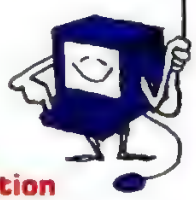

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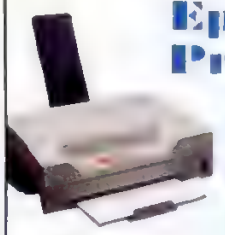

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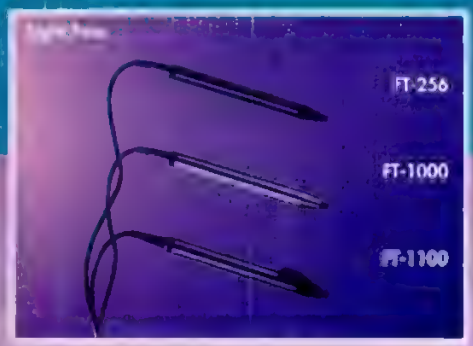

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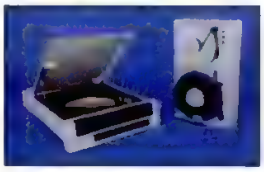

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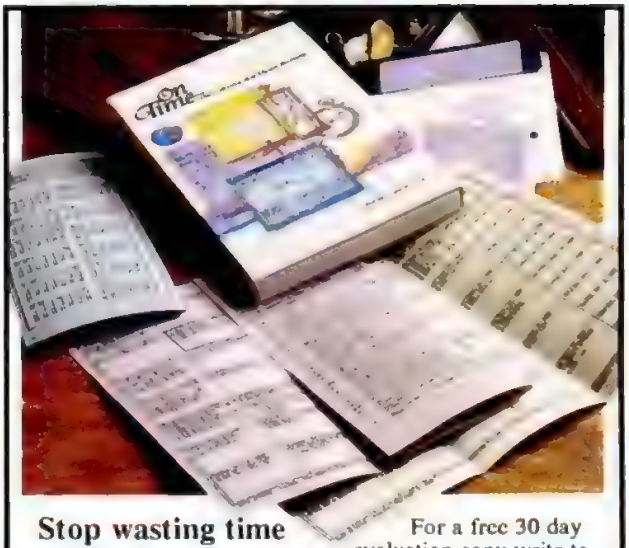
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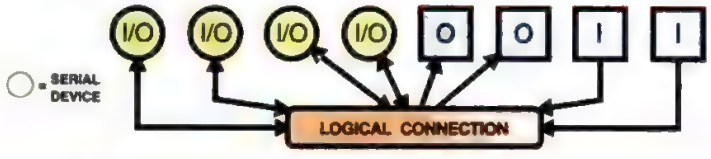

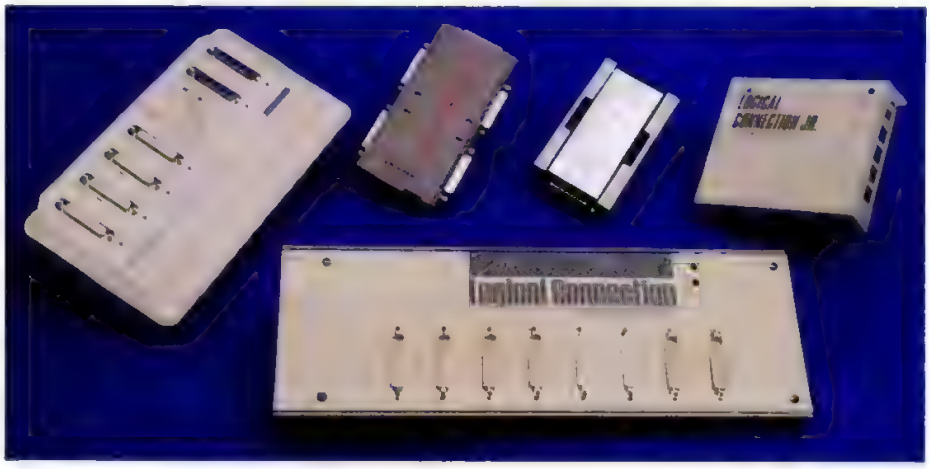

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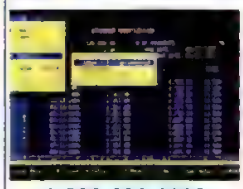

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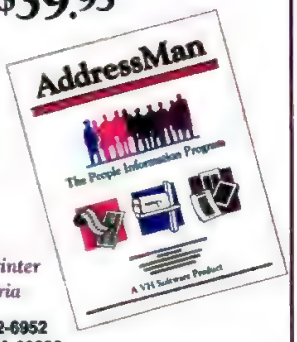

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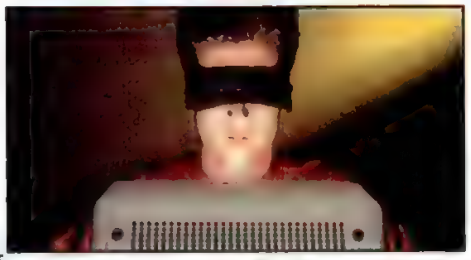

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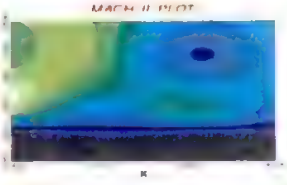

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18 ☐ Other Business or Service
99. ☐ Other

3. Please indicate your primary business function: (Check one only.)
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03 ☐ Communications
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05. ☐ Res./Dev./Scientific
06. ☐ Accounting/Finance
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99. ☐ Other

4. Is your company a reseller?
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5. For how many IBM PCs and compatibles do you specify brands of products:
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02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply.)
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02. ☐ Linked to mini
03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply)
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03. ☐ IBM or Compatible Minis
04. ☐ Macintosh
05. ☐ CD-ROM
06. ☐ Windows

8. Do you plan to buy any PC Products?
01. ☐ Now
02 ☐ In 4 to 6 months
03. ☐ In 7 to 12 months
04. ☐ No definite plans

9. Number of Employees in your entire company:
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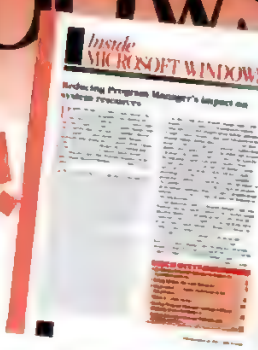

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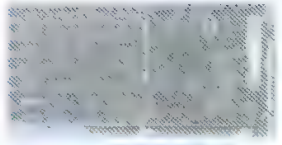

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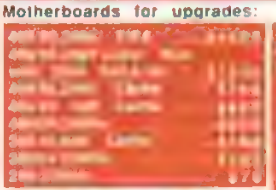

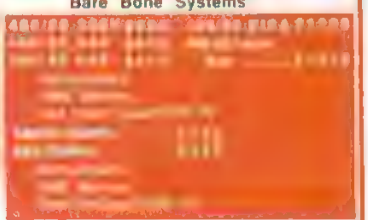

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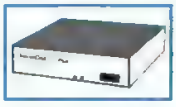

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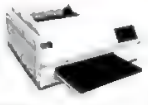

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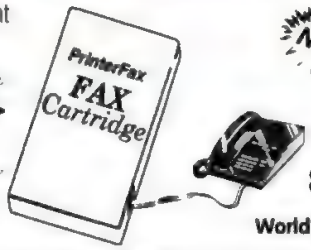

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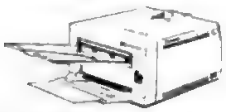

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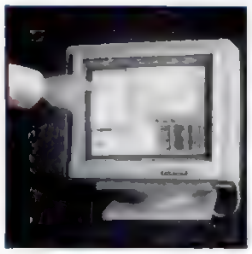

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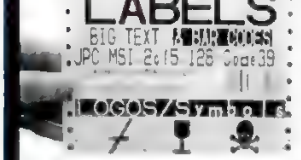

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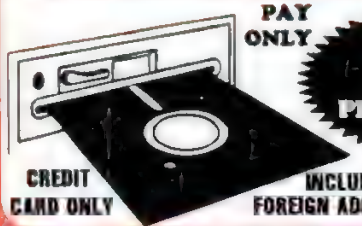

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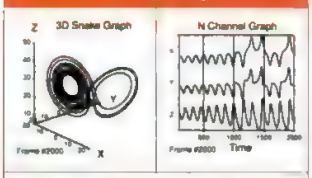

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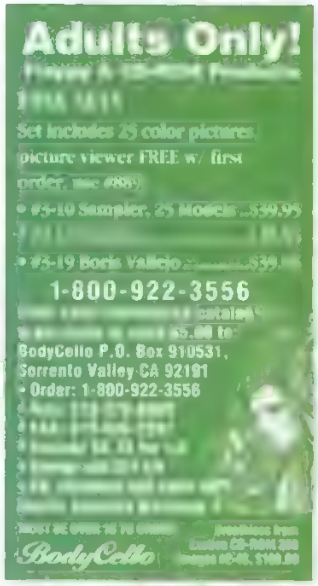

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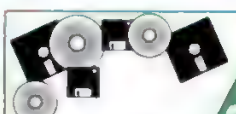

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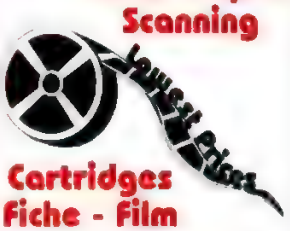

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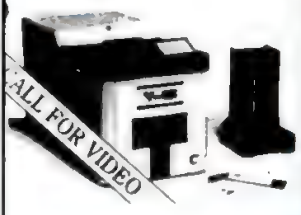

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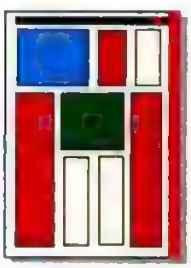

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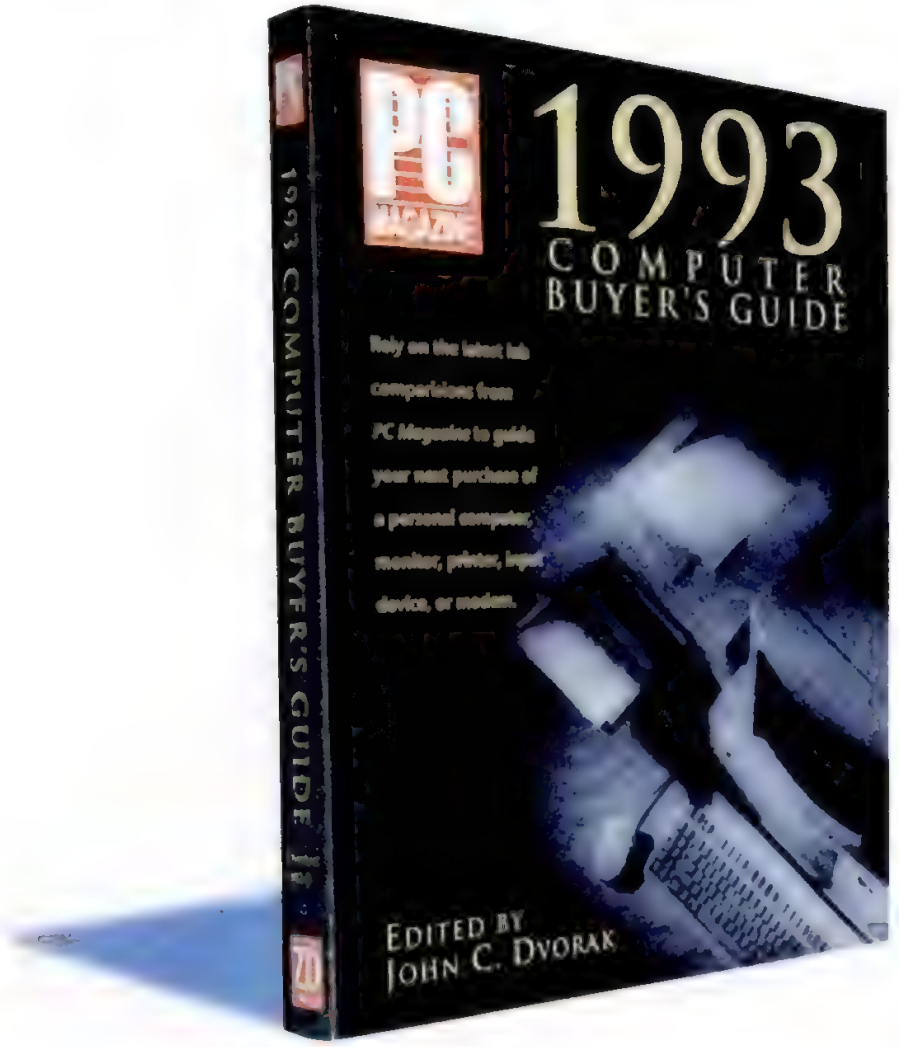

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Anna Zornosa - Associate Publisher/West Coast
(415) 378-5505

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(312) 346-7666

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Ad Systems Supervisor
Christine Holsten
(212) 503-5264

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PC MAGAZINE

Coming Up

The 9th Annual Awards for Technical Excellence

PC Magazine's best-kept annual secret is revealed as we reward the hardware and software innovations of 1992. We handpick the best and the brightest, in categories from Operating Systems to After Hours. And lest we forget, great products are born from great minds. Besides singling out salient developments, we salute the industry's most creative people for their crowning achievements.

Massive Portable Roundup

Slim, light, and powerful are the qualities that traveling executives cherish in a portable computer. PC Magazine Labs takes to the road to test the latest from Advanced Logic Research, Compaq, Dell, and Toshiba. In all, we take a look at 70 of the most advanced notebooks, subnotebooks, and state-of-the-art color machines to see which are most appropriate for computing on the go.

CD-ROM Drives

As CD-ROM drives drop in price, continuous-transfer rates improve, and the choice of available CDs expands, CD-ROM drives will soon be on most computer users' desks. *PC Magazine* takes a look at desktop and portable CD-ROM drives, as well as the fast-growing CD-ROM application and multimedia market and the burgeoning recordable CD technology.

Holiday Favorites

This holiday season, make your home computer a family hit. In our annual look at some of the year's best PC programs and paraphernalia, we offer more than 30 gift ideas to please the entire family. From children's software to grownup productivity packages, and from MIDI setups to games, these products will find a place in your home.

Utilities

Batch files make executing a series of commands quick and simple. Now, using STRINGS 2.0, you can make them versatile, too. Version 2.0 is an upgrade of the original utility STRINGS. The new version enhances a number of the original functions and implements more than 35 new ones. In addition, the program has been rewritten as a TSR so you can install it as an extension to COMMAND.COM. This allows STRINGS 2.0 commands to function with the speed of COMMAND.COM's internal commands. □

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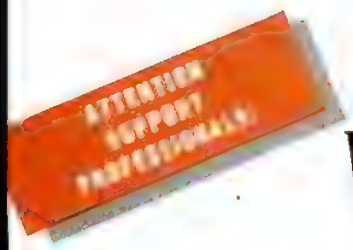

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After Hours

Home Graphics: The Print Shop Deluxe from Broderbund **Children's Games:** Time Riders in American History, Snoopy's Game Club, Where in the USA Is Carmen Sandiego? Deluxe Edition

HOME GRAPHICS

Print Shop Deluxe: Broderbund Updates Home Graphics Classic

BY DON TRIVETTE

After pioneering the home graphics software market with The Print Shop, and then letting technology pass the product by, Broderbund has released a worthy successor to its best-selling package. The Print Shop Deluxe taps the power of the 386 and the VGA card—innovations that did not exist when the original version appeared in 1984.

With The Print Shop Deluxe, you can create personalized greeting cards, signs, stationery, and banners and choose from scores of suggested layouts and hundreds of canned graphical elements. Without the jagged text that marked the original product, these images are even professional enough to use for business purposes.

The Print Shop Deluxe's main menu gives access to five types of projects: greeting cards, letterhead stationery, signs, calendars, and banners.

After you've selected a project, you use a series of menus to choose the orientation (side fold, top fold, side-fold spread, or top-fold spread) and one of a dozen backgrounds. Selections from these menus and throughout the program are made by mouse or by Tab and cursor keys. In fact, Print Shop Deluxe is one of the few graphical products that you can comfortably use without a mouse. The highlight bar skips quickly and clearly from selection to selection at the press of a key. The user interface is well designed and intuitive; there's none of the Shift-Alt-Ctrl combinations too often found in keyboard interfaces.

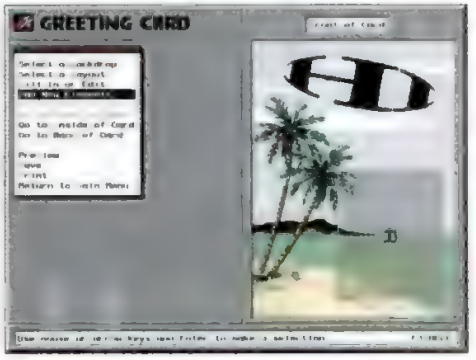
Once the stage is set, the program prompts you to choose a layout. This feature is a major enhancement that practically does the composition and design for you, although you can still use a blank layout to express your own artistic abilities.

Each project has its own layouts, orientations, and backgrounds. Signs, for instance, have 30 vertical and 39 horizontal layouts; banners have 21 vertical and 28 horizontal layouts. There are 32 choices for letterheads, 22 for notepads, and 25 for greeting cards. There are even 10 different ways to design a calendar, which itself can be yearly, monthly, weekly, or daily. Multiply these factors by the choices for font, graphics, and color, and you will find that the number of unique designs you can create will rival the variety found in a Hallmark store.

The Print Shop Deluxe uses containers to hold each graphical element. You can place borders, headlines, text, graphics, or ruled lines in these containers. A greeting card layout uses as many as 12 containers, all tastefully arranged on a preview page. One such card contains a square container for a large graphics element sitting above a container for a pennant headline.

Once you've settled on a layout, you can fill the graphics containers with designs: an American flag for the Fourth of July or an Easter bunny, for example.

The Print Shop Deluxe has more than 300 object-oriented designs, most in color. Seventy of those designs can be used on greeting cards. A miniature of the selected design appears in a preview window. You can even put the same element into all the graphics containers in the layout to produce a repetitive motif.



Broderbund's updated classic, The Print Shop Deluxe, contains hundreds of predefined layouts.

The program's text treatment has improved as well. You can choose from 30 different fonts when you type your greeting into the headline container. You can also customize the color, justification, and style of the text; view it as a wire frame; or add shadows and perspective. Unlike the original Print Shop, these attributes can be adjusted on a character-by-character rather than line-by-line basis.

The program is missing one important capability, however: It offers no way to preview the fonts. Only the descriptive-sounding names—such as Bazooka, Librarian, and Signature—give a clue to their appearances. Although it doesn't take long to try the different styles, Broderbund should have included some samples, either in the package or in the 100-page reference manual.

After the basics of a project are in place—background, layout, graphics, and greeting—you can fiddle with the subtleties. For example, you can change the shading percentages for multicolor graphics or blend one color into another. Editing tools that move, resize, rotate, order, and delete can be used to customize the overall appearance of the card, though the compositions suggested by the layout are well balanced.

NO MORE JAGGIES

There is good news for those of us who have awaited an inexpensive end to the jaggies: The Print Shop Deluxe uses vector graphics for drawing text instead of the older bitmapped graphics. Not only can you shrink, enlarge, stretch, flip, and rotate text and graphics, but the resulting printout lacks the jagged edges typical of bitmapped

The Print Shop Deluxe

characters. Output looks smooth and professional, even from a 9-pin printer.

Although The Print Shop Deluxe supports all major printers, including some inexpensive color ones, it does not have generalized graphics export or import options. You cannot, for example, create a .PCX or TIFF file. You can, however, export most of the 300 individual graphics elements for use in other programs. There's also a new coloring-book option; with it, you can print outlines that just beg for a four-year-old's crayon.

The Print Shop Deluxe costs just $20 more than The New Print Shop, but there is an additional price to pay in hardware requirements. The Print Shop Deluxe requires at least a 386SX processor, 1MB of memory, VGA video, and a hard disk.

Output from The Print Shop Deluxe is professional enough for businesses.

Broderbund is also set to release Print Shop for Windows with support for TrueType fonts; this program will have the same features as The Print Shop Deluxe but will use the familiar Windows interface. For users who haven't stepped up to 386 technology, the company sells an upgraded version of the original product, now called The New Print Shop. The only thing wrong with this product is that Broderbund didn't include a color printer. When you see your artwork on-screen, you will surely want one.

The Print Shop Deluxe, $79.95. Requires: *1MB RAM, 5MB hard disk space, VGA display, DOS 3.0 or later. Broderbund Software Inc., 500 Redwood Blvd., P.O. Box 6121, Novato, CA 94948-6121; 800-521-6263, 415-382-4400; fax, 415-382-4582.*

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CHILDREN'S GAMES

Time Riders in American History Blows Headlines Apart; Children Must Race to Reconstruct the Truth

BY CAROL ELLISON

The Learning Company's newest educational game, Time Riders in American History, is a historical hit. It combines the fun and action of a Saturday morning adventure cartoon with lessons from history. The result is entertaining enough to make a kid welcome a pop quiz.

Geared at ages ten to adult, Time Riders plunges players into a kind of Mission Impossible challenge. They must correct misbegotten truths about American history being broadcast by the evil Thanatopsis Dread before time runs out. The evil Dread has captured Earth's TeleNews satellite and threatens to change history by broadcasting lies such as "Great-Grandma Dread Wears Metal Curlers in Thunderstorm; Fries Hair and Proves Lightning is a Form of Electricity."

Meanwhile, back on Earth, the Benefactor and his band of Time Riders plot to stop him. They gather in the Benefactor's Sea Cliff Mansion, where, equipped with computers, communicator, Time Tube, and Rocket Launcher—and with the player as their leader—they work to correct the bogus broadcasts and uplink the correct information. Players race the clock with two students, Amanda and Josh, and their droid kitten, KAT (Knowledge Access Terminal), to determine the correct year, place, and person associated with given events.

Time Riders' sound, animation, and lustrous 256-color VGA graphics enhance the play. The game features 145 events in history from 1492 to 1905 and highlights the achievements of 114 famous Americans from a wide variety of ethnic and social groups.

KAT's time tube helps the Time Riders associate the right people with the events that shaped American history.

The mysteries are familiar tales from history: Thomas Edison's invention of the light bulb or Benjamin Franklin's discovery of electricity, for instance. The game provides plenty of help for younger players who don't readily recognize the proper time, place, and person to correct Dread's false tale. Kids can use the communicator to receive tips from Amanda—the history buff—to zero in on the proper year. Josh—the geography maven—helps find the place an event occurred. KAT assists with biographical data and provides comic relief with clever quips and constant urgings to move quickly.

It's all good fun, and as the game proceeds and the true headlines become more difficult to figure out, Mom and Dad might even learn a thing or two.

Time Riders would benefit from a reference book to encourage kids' offscreen research activity; all the child's research is done from within the game. There are no almanacs or maps to assist in the search for clues. The 49-page manual provides a wonderful guide to playing the game, as well as tips for projects that a teacher or parent can use to encourage further study. But to get the most out of Time Riders, players will want to supplement it with a trip or two to the library to look up the people and places that made the real headlines.

Time Riders in American History, $59.95. Requires: *640K RAM, 3MB hard disk space, DOS 3.0 or later. The Learning Co., 6493 Kaiser Dr., Fremont, CA 94555; 800-852-2255, 510-792-2101; fax, 510-792-9628.*

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CHILDREN'S SOFTWARE

Snoopy's Game Club Uses Puzzles, Lookalikes To Teach Young Children New Computer Tricks

BY DON TRIVETTE

Snoopy, Lucy, Woodstock, Charlie Brown, and their pals have appeared in numerous books, newspapers, and television specials for decades, so it's no surprise that they have finally made it to the VGA screen.

Snoopy's Game Club, by Accolade, is designed for kids three to eight years old. Although it may not be the most intellectually stimulating of computer games, the program's animated jigsaw puzzles, picture pairs, and lookalikes will hold a child's attention for hours, help develop hand-eye coordination, and provide a good memory workout.

The object of the animated puzzles is to put the pieces back together in as few moves as possible; the number of pieces can range from an easy 4 to an impossible 144. There are nine different puzzles, and each contains at least one animated feature, such as a bubbling fountain or a floating hot-air balloon. A counter at the bottom keeps track of moves, but most kids will probably ignore it.

Unlike those of an interlocking jigsaw, the edges of these puzzle pieces are straight. The child must use a picture's color, content, and animation in order to locate adjacent pieces. Rather than drag the puzzle pieces into position, the child clicks on the two pieces that he thinks should be adjacent. If your children need help, they can click on a Snoopy icon to get a picture of the completed puzzle.

This game was a genuine puzzle the first time I tried it. I had to read the manual to decipher a number of icons, a good indication that this part of the interface needs a little work.

Charlie Brown's picture pairs is a takeoff of the television game show, Concentration. At the easiest level, there are 8 squares to match; at the most difficult, 36. Some pictures behind the squares are graphics, such as Charlie Brown flying a kite; others, designed for older children, are letters of the alphabet. To keep this task from getting tedious, especially with 36 squares, a child can compete with a friend or against the computer. (Of course, the computer opponent has a perfect memory.)

Children use color, content, and animation to solve Snoopy's jigsaw puzzle.

Woodstock's lookalikes is simple at first glance. Just match two identically colored objects. This is easy when there are just 6 objects, but with 18 items, there are subtle differences to consider. Real concentration is required to find two matching autumn leaves when there are 18 on the screen. The faster a child identifies the pairs, the higher the score. Like picture pairs, lookalikes can be played with a friend.

Snoopy's Game Club supports several sound boards, including AdLib, Sound Blaster, and Roland. A player can turn the music off while leaving the sound effects and digitized voice on or can disable them all—a good idea if using a system not equipped for sound.

Accolade and other children's software developers could improve their products by figuring out a way to change the mouse's sensitivity from within the game. Small hands aren't as agile as adult ones.

Snoopy's Game Club doesn't underestimate the learning curve and tenacity of small children. A bright three-year-old will quickly learn to solve a puzzle with 6 pieces. After a few months, the same child will be able to solve 64-piece puzzles. Snoopy's Game Club is like a pair of shoes one size too large: It gives your child room to grow.

Snoopy's Game Club, $49.95. Requires: *640K RAM, DOS 2.1 or later; mouse recommended. Accolade Inc., 5300 Stevens Creek Blvd., San Jose, CA 95129; 800-245-7744, 408-985-1700; fax, 408-246-0885.*

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CHILDREN'S GAMES

Carmen Sandiego's U.S.A. Trek Continues In Deluxe Style

BY CAROL ELLISON

Few software programs have endured as long and enjoyed as much success as Broderbund Software's Carmen Sandiego educational game series. Carmen thrives both on and off the software shelves of computer stores and can be found in television shows, books, board games, and even a movie. But Broderbund isn't about to let Carmen's offscreen popularity relegate her computer presence to the scrap heap. Where in the USA is Carmen Sandiego? Deluxe Edition ($79.95) brings faster action and more fun to an old favorite.

What distinguishes the deluxe version from the standard version is its complexity and its wealth of audio/visual detail. The video quality in the standard edition was CGA. In this high-resolution VGA version, six talking characters—including the Chief, Warrant Officer Wanda, and various informants—appear onscreen to help guide you in the chase.

Carmen Deluxe features more than 3,000 clues—twice as many as the standard edition—and five successive levels of difficulty. Fifteen comic henchmen—with names like Mae Hemm, Hal E. Luya, Armand Geddon, and Polly Graph—perform animated antics to a musical score as you narrow the chase.

Carmen Deluxe

Informants whisper their tips as text of what they're saying appears on-screen. You don't need a sound card to play the game, but you'll certainly enjoy it more if you have one; the PC speaker alone cannot broadcast the voice.

Sound support may be limited by the capabilities of the sound card or the settings on them, however. If your PC is chock-full of add-in cards, you may have to fiddle with a few switches to achieve full audio effects. While music and voice came through beautifully when my Creative Labs' Sound Blaster Pro was set at factory defaults, I could not hear voice when the board was configured for other settings.

The basics of this game are no different here than they are in other games in the series. A landmark has been stolen: Sandusky Bay from Ohio, the Churchill Downs grandstand from Kentucky, or one of 78 others. You must track down and arrest the suspect and return the booty to its rightful place. You begin as a gumshoe and work your way up to Super Sleuth.

All the tools of your trade are on-screen as part of your communicator, a kind of pocket videophone with a computer attached. You use this tool to receive instructions from the detective agency. You also make travel plans, record notes, and keep a to-do list in an attached notebook.

This, incidentally, is one of the few Carmen Sandiego games in which you will actually see the arch villainess herself appear on the screen.

As the game opens, an animated Carmen cruises around San Francisco in her red convertible sportster, the Trans-America Pyramid in the distance. Next, we see the legendary Acme Detective Agency. Like the game's other splendid scenes—set in all 50 states as well as Washington, DC—this scene is displayed in 256-color VGA graphics.

Carmen Sandiego gets the graphical treatment the game deserves, complete with photos from every U.S. state.

Like all Carmen Sandiego games, this one comes with a reference book. This time, it's Broderbund's own edition of Fodor's USA. Although text is pegged to the game, the book includes information Mom and Dad can use for their own travel plans: local tourist attractions, hotels and motels, places to eat, and the landmarks Carmen tries to lift.

Where in the USA is Carmen Sandiego? Deluxe Edition, $79.95. Requires: *640K RAM, 8MB hard disk space, DOS 3.1 or later, Broderbund Software, 500 Redwood Blvd., Novato, CA 94948; 800-521-6263, 415-382-4400; fax, 415-382-4582.*

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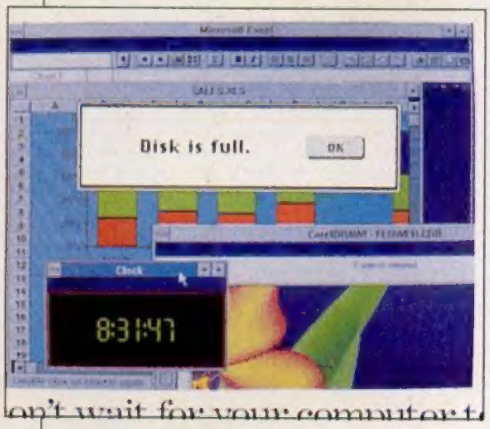
Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Bill Howard

For $2,000, You Do Get a Choice of Click or No-Click

"In another example of flexible furniture, a changing table converts to a computer keyboard. However, quality comes at a price: Sempel reports that the average sale at his Bellini store is between $2,000 and $3,000."
—*The Tampa Tribune*, August 22, 1992



Best of all, the drives work across platforms: In SyQuest's ad for its 5.25-inch removable hard disk cartridges, there's a Mac error message embedded in a Windows display.

Help Wanted

"Facility Coordinator for treatment center. Must have bachelor's degree in health related areas, computer illiterate, supervisory skills, good communication skills. Must be flexible and able to meet the public and possess knowledge of the 12 steps."
—*Post-Bulletin*, Rochester, MN, June 3, 1992

How green is my printer: The Epson 5000 printer comes with a "biodirectional" printhead, according to this Nobody Beats the Wiz circular.

According to this Tandy ad, your choices are a 40MB drive for $299.95 and a 52MB drive for $279.95.

Amazing Facts

"The [Compaq server] processor bus will operate at 64 bits per second (bps), with the memory bus set at 128 bps."
—*InfoWorld*, September 7, 1992

"The computer's ability to work quickly in moving data or processing information depends on the speed of this chip, measured in *kilohertz*. The original IBM PC used an "8088" CPU, running at around 5 kilohertz."
—*Consumers Digest*, September/October, 1992

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of each entry are considered. Winners this issue: Margaret Stephan (flexible furniture), Nikhil Manudhane (SyQuest), Gary Mullen-Schultz (computer illiterate), Rich Borzone (biodirectional print), Duane Martin (larger drive, lower price), Christopher Barr (64-bps Compaq server), William E. Krause (measured in kilohertz).

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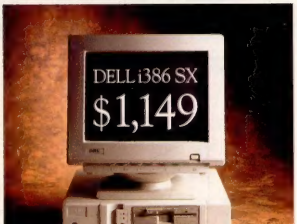

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